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**Mail Stop Appeal Brief**

**PATENT**  
Customer Number 22,852  
Attorney Docket No. 04329.2199

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re Application of: )  
)  
Kenro NAKAMURA, et al. ) Group Art Unit: 1765  
)  
Serial No.: 09/453,831 ) Examiner: Umez-Eronini, Lynette T.  
)  
Filed: December 2, 1999 )  
)  
For: POLISHING METHOD AND )  
POLISHING LIQUID )

**Mail Stop Appeal Brief - Patents**  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

**TRANSMITTAL OF APPEAL BRIEF (37 C.F.R. § 1.192)**

Transmitted herewith in triplicate is the APPEAL BRIEF in this application with respect to the Notice of Appeal filed on August 19, 2003. The due date for response extends through Monday, October 20, 2003 (October 19<sup>th</sup> being a Sunday).

This application is on behalf of

☐ Small Entity ☒ Large Entity

Pursuant to 37 C.F.R. 1.17(f), the fee for filing the Appeal Brief is:

☐ \$160.00 (Small Entity)  
☒ \$330.00 (Large Entity)

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Extension Fee (if any)\$ 0.00

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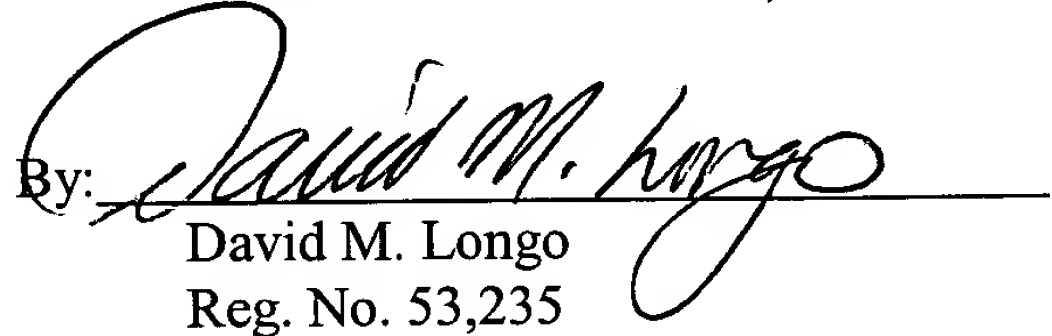
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PETITION FOR EXTENSION. If any extension of time is necessary for the filing of this Appeal Brief, and such extension has not otherwise been requested, such an extension is hereby requested, and the Commissioner is authorized to charge necessary fees for such an extension to our Deposit Account No. 06-0916. A duplicate copy of this paper is enclosed for use in charging the deposit account.

FINNEGAN, HENDERSON, FARABOW,  
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Dated: October 20, 2003

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**I. Real Party in Interest**

The real party in interest is Kabushiki Kaisha Toshiba, a corporation of Japan, by virtue of an assignment that was recorded on December 2, 1999, at Reel 010432, starting at Frame 0017.

**II. Related Appeals and Interferences**

There are currently no known Appeals or Interferences related to this application that are awaiting decision by the Board of Patent Appeals and Interferences. An Appeal Brief was filed on August 5, 2002, but prosecution was reopened with a nonfinal Office Action on December 12, 2002. An Amendment was filed on March 11, 2003, and a Final Office Action was issued on May 20, 2003, to which this Appeal Brief is addressed.

**III. Status Of Claims**

Claims 11 – 26 are pending for the purposes of this Appeal Brief, with claims 13 – 16 withdrawn from consideration as drawn to a nonelected invention, Appellants having traversed the restriction requirement in the Amendment filed on November 8, 2001 in paper No. 5. For the purposes of this Appeal Brief, claims 24 and 26 have been rejected under 35 U.S.C. § 112, first paragraph; claims 11 and 17 – 21 have been rejected under 35 U.S.C. § 103(a); claim 12 has been rejected under 35 U.S.C. § 103(a); and claim 22 has been rejected under 35 U.S.C. § 103(a). Claims 23 and 25 were not listed as rejected in the Final Office Action. Claims 11, 12, and 17 – 26, on appeal, are set forth in an attachment entitled "Appendix A."

**IV. Status Of Amendments**

Appellants filed an Amendment on March 11, 2003. In a Final Office Action, dated May 20, 2003, the Examiner repeated the rejections of claims 11, 12, and 17 – 22, added a rejection of claims 24 and 26, and did not explicitly reject claims 23 and 25. Claims 23 and 25

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were only mentioned in passing, in the body of the rejection of claims 11 and 17 – 21 (claim 23), and in the rejection of claim 22 (claim 25). The claims have been amended during prosecution of the present application, and all amendments submitted have been entered.

**V. Summary Of Invention**

The present invention relates to a polishing method useful in chemical mechanical polishing ("CMP"), comprising preparation of a first polishing liquid containing tetravalent cerium ions (or cerium (IV) nitrate) in a first concentration; adding a solvent to the first polishing liquid to form a second polishing liquid containing tetravalent cerium ions (or cerium (IV) nitrate) in a second concentration lower than the first concentration, followed by polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, wherein the addition of the solvent is carried out upon, or immediately before, the polishing of said substrate. (*See Appellants' claims 17 and 22, for example.*)

As semiconductor device component dimensions continue to decrease, thereby enabling denser packing of integrated circuits ("ICs") on wafers, CMP has emerged as a fundamentally necessary tool for modern IC fabrication. CMP is used to polish and flatten wafer surfaces between processing steps to eliminate unwanted material from the surface of a partially fabricated device, which in turn prepares the surface for subsequent processing steps (such as film deposition, etc.).

CMP utilizes a polishing liquid or slurry between the surface to be modified and a rotating pad or disk. A range of polishing liquids are available, and these liquids contain materials designed to chemically and mechanically "attack" the surface to which they are applied. This combination of chemical and mechanical removal of material results in a highly-efficient surface preparation technique.

Surfaces prepared by CMP are extremely flat, which is ideal for modern IC fabrication. This contrasts with conventional wet etching and dry etching technologies, which may not produce a flat or even surface in a reproducible manner. While wet etching and dry etching technologies are useful in certain aspects of IC fabrication, CMP is used to remove unwanted material in a highly-controlled and reproducible manner.

Processing during the fabrication of dynamic random access memory ("DRAM") chips and next-generation nonvolatile ferroelectric random access memory ("FRAM") chips includes formation of dielectric films that are compatible with lower electrode materials. Compatibility is judged in part by low lattice mismatch at the atomic-scale interface between the materials, wherein low lattice mismatch reduces interfacial strain and also improves adhesion of deposited film layers. To improve this interface compatibility, materials with similar crystal structures are selected for different layers in a given device, e.g., for the interface between an electrode layer and a dielectric layer. Noble metals or conductive oxides of perovskite-type crystal structure are preferred for the lower electrodes and dielectric films, e.g., ruthenium (Ru) and Ru-compounds such as Ru-oxides, particularly  $\text{SrRuO}_3$ . These materials, however, are chemically stable in general and therefore ideal for use in DRAMs and FRAMs, but this makes it difficult to employ standard processing techniques (i.e., wet etching or dry etching, mentioned earlier) for fabrication of lower electrodes and dielectric films. (Specification, p. 1, l. 18 – p. 2, l. 5). Since wet etching or dry etching may not produce flat surfaces reproducibly when applied to noble metals or conductive oxides of perovskite-type crystal structure, CMP is ideal for processing these materials in a reproducible manner.

Exemplary processing steps are illustrated, for example, in Appellants' specification, Figs. 2A – 2C, wherein CMP is shown being used to prepare a  $\text{SrRuO}_3$  lower electrode 15 in a

patterned region of  $\text{SiO}_2$  stopper film 13 to prepare the surfaces of these materials for deposition of a  $\text{BaSrTiO}_3$  dielectric film. (See also Specification, p. 18, l. 10 – p. 19, l. 22).

Effectiveness of CMP is aided by the choice of polishing liquid or slurry. Conventional polishing liquids are defective for CMP surface preparation of noble metals or conductive oxides of perovskite-type crystal structure, in that the polishing rate is low. Low polishing rates result in low manufacturing efficiency. Furthermore, conventional polishing liquids do not distinguish between these new materials during polishing, e.g., between lower electrode materials (e.g.,  $\text{SrRuO}_3$ ) and those materials used as “stopper films” (e.g.,  $\text{SiO}_2$ ) (to indicate a certain depth of polishing). This low selectivity between material types makes it difficult to obtain a uniform and stable processed surface during CMP. (Specification, p. 2, ll. 12 – 20).

The present invention solves these problems by providing a polishing method that effects a high polishing rate and a high selectivity ratio relative to the underlying film layers, in situations where noble metals or conductive oxides of perovskite-type crystal structure are polished using CMP, particularly for Ru and Ru-compounds such as  $\text{SrRuO}_3$ .

## **VI. Issues**

**A. Whether claims 24 and 26 define patentable subject matter under 35 U.S.C. § 112, first paragraph.**

**B. Whether claims 11 and 17 – 21 define patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland (U.S. Patent No. 6,143,192) in view of Danielson, et al. (U.S. Patent No. 5,407,526).**

**C. Whether claim 12 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, et al. (U.S. Patent No. 4,574,292).**

**D. Whether claim 22 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson.**

## **VII. Grouping Of Claims**

All of the claims, at issue in "Section VI" above, do not stand or fall together.

1. Regarding the rejection under 35 U.S.C. § 112, first paragraph, claim 24 stands alone and claim 26 stands alone.

2. Regarding the rejections under 35 U.S.C. § 103(a), claims 11 and 17 – 21 stand together, claim 22 stands alone, and claim 12 stands alone as dependent from base claim 17.

3. Claims 23 and 25 each stand alone, as they were incorporated into the body of the rejection of claims 11 and 17 – 21, and the body of the rejection of claim 22, but not explicitly rejected or objected to in the Final Office Action of May 20, 2003.

## **VIII. Argument**

**A. Claims 24 and 26 define patentable subject matter under 35 U.S.C. § 112, first paragraph.**

The Examiner rejected claims 24 and 26 under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the written description requirement. The Examiner alleged that "[t]he claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the



application was filed, had possession of the claimed invention.” (Final Office Action, p. 2). The Examiner failed to substantiate this allegation. Instead, the Examiner quoted a portion of Appellants’ claims 24 and 26, which recite, *inter alia*, “wherein said solvent consists essentially of water.” *Id.* The Examiner then quotes M.P.E.P. § 2163(II)(A)(1), 8th Ed. (Rev. Feb. 2003), p. 2100-63, without citation, to allege that Appellant “has the burden of showing that the introduction of additional steps or components would materially change the characteristics of [Appellants’] invention” (Final Office Action, p. 2, and M.P.E.P. § 2163(II)(A)(1)), presumably because a “‘consisting essentially of’ claim occupies a middle ground between closed claims that are written in a ‘consisting of’ format and fully open claims that are drafted in a ‘comprising’ format.” *PPG Industries v. Guardian Industries*, 156 F.3d 1351, 1354, 48 USPQ2d 1351, 1353-54 (Fed. Cir. 1998).” *Id.*

1. The Examiner has not presented any evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims.

The M.P.E.P. instructs that

*“The examiner has the initial burden, after a thorough reading and evaluation of the content of the application, of presenting evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims. There is a strong presumption that an adequate written description of the claimed invention is present in the specification as filed, Wertheim, 541 F.2d at 262, 191 USPQ at 96...”* M.P.E.P. § 2163(II)(A), p. 2100-163, italics added.

Appellants submit that the Examiner has not presented any such evidence or reasons to Appellants in the Final Office Action, absent only a blanket allegation that “[in claims 24 and

26] “wherein said solvent consists essentially of water” is not supported by the Specification”  
(Final Office Action, p. 2).

The M.P.E.P. goes on to say “however, with respect to newly added or amended claims, [Appellant] should show support in the original disclosure for the new or amended claims.” M.P.E.P. § 2163(II)(A)(1), p. 2100-163. To make this point abundantly clear, Appellants respectfully direct the Board’s attention to the specification, p. 5, lines 16 – 23 (“the polishing liquid ... is prepared by dissolving cerium (IV) nitrate in a solvent... Of course, an aqueous solution of cerium (IV) nitrate and an aqueous solution of diammonium cerium (IV) nitrate can be used as effective polishing liquids in the present invention”), p. 7, lines 11 – 17 (“polishing liquid ... which was prepared by diluting with water an aqueous solution containing 20% by weight of diammonium cerium (IV) nitrate”), p. 9, lines 12 – 15, p. 11, lines 8 – 11, and p. 13, lines 9 – 13 (“a polishing liquid prepared by adding diammonium cerium nitrate to a dispersion prepared by dispersing alumina particles ... in water”), p. 18, line 27 to p. 19, line 2 (“An aqueous solution containing 1% by weight (or 1 to 2% by weight) of diammonium cerium nitrate is used as the polishing liquid”), and p. 20, lines 18 – 21 and p. 22, lines 16 – 20 (“An aqueous solution containing 1% by weight (or 1 to 2% by weight) of diammonium cerium nitrate, which does not contain abrasive grains, is used as the polishing liquid”).

Having demonstrated that Appellants’ specification *does* contain subject matter described in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention, Appellants point out that

“[a] description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the examiner to rebut the presumption. See, e.g., *In re Marzocchi*, 439 F.2d 220, 224,

169 USPQ 367, 370 (CCPA 1971). *The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description. The examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the claims. Wertheim, 541 F.2d at 263, 191 USPQ at 97.*" M.P.E.P. § 2163.04, p. 2100-173, italics added.

Appellants submit that the Examiner has not (a) presented sufficient evidence or reasoning to the contrary, or (b) presented by a preponderance of evidence why a person skilled in the art would not recognize in an Appellants' disclosure a description of the invention defined by the claims at issue.

2. *The Examiner has not determined what the claim, as a whole, covers.*

The Examiner quotes M.P.E.P. § 2163(II)(A)(1), without citation, to point to the use of the phrase "consisting essentially of" in Appellants' claims 24 and 26, and to allege that Appellant "has the burden of showing that the introduction of additional steps or components would materially change the characteristics of [Appellants'] invention" (Final Office Action, p. 2, and M.P.E.P. § 2163(II)(A)(1)).

In response, Appellants note that the Examiner has quoted the M.P.E.P. in such a way that obfuscates the context of its discussion regarding transitional phrases in claim language, and, as such, inadvertently ignores the requirement that "[e]ach claim must be separately analyzed and given its broadest reasonable interpretation in light of and consistent with the written description. See, e.g., *In re Morris*, 127 F.3d 1048, 1053-54, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). *The entire claim must be considered*, including the preamble language and the transitional phrase." M.P.E.P. § 2163(II)(A)(1), italics added.

Directly before the quote cited by the Examiner, the M.P.E.P. points out that “[b]y using the term ‘consisting essentially of,’ the drafter signals that the invention necessarily includes the listed ingredients and is open to unlisted ingredients that do not materially affect the basic and novel properties of the invention.” *Id.*, internal citation omitted. Furthermore, directly after the quote cited by the Examiner, the M.P.E.P. goes on to say that “absent a clear indication in the specification or claims of what the basic and novel characteristics actually are, “consisting essentially of” will be construed as equivalent to “comprising.”” *Id.*, internal citation omitted.

Contrary to the Examiner’s allegation, only if

“an applicant contends that additional steps or materials in the prior art are excluded by the recitation of “consisting essentially of,” applicant has the burden of showing that the introduction of additional steps or components would materially change the characteristics of applicant’s invention. *In re De Lajarte*, 337 F.2d 870, 143 USPQ 256 (CCPA 1964). See also MPEP § 2111.03.” *Id.* at 2100-164.

Appellant has not contended before the Examiner that additional steps or materials in the prior art are excluded by the recitation of “consisting essentially of.” As evident from the eight citations to the specification above to show support for the recited elements of claims 24 and 26, Appellants submit that they have shown “possession of the claimed invention by describing the claimed invention with all of its limitations. *Lockwood*, 107 F.3d at 1572, 41 USPQ2d at 1966.” *Id.* Furthermore, under this rubric, Appellants submit that “[t]he absence of definitions or details for well-established terms or procedures should not be the basis of a rejection under 35 U.S.C. 112, para. 1, for lack of adequate written description.” *Id.*

Appellants therefore submit that the claimed phrase, “wherein said solvent consists essentially of water,” fully complies with the written description requirement of 35 U.S.C. § 112,

first paragraph, and that this claim element is “expressly, implicitly, or inherently supported in the originally filed disclosure.” M.P.E.P. § 2163(II)(A)(3)(b), p. 2100-169.

Since “[t]he fundamental factual inquiry is whether the specification conveys with reasonable clarity to those skilled in the art that, as of the filing date sought, applicant was in possession of the invention as now claimed. See, e.g., *Vas-Cath, Inc.*, 935 F.2d at 1563-64, 19 USPQ2d at 1117” (M.P.E.P. § 2163(I)(B), p. 2100-163), this rejection should be overturned at least for the reasons presented above, including the eight citations to Appellants’ specification showing support for claims 24 and 26.

Appellants submit that the rejection of claims 24 and 26 under 35 U.S.C. § 112, first paragraph, should be reversed, because Appellants’ subject matter has a complete and clear description in the specification in such a way as to convey to one of ordinary skill in the art that Appellants had possession of the claimed invention at the time the application was filed. The language of claims 24 and 26 clearly complies with the written description requirement. Appellants submit that all subject matter in “the specification conveys with a reasonable clarity to those skilled in the art that, as of the filing date sought, [Appellants were] in possession of the invention as now claimed” (M.P.E.P. § 2163), and that Appellants have fully satisfied their burden to “show support in the original disclosure for the new or amended claims” (*Id.*).

Claims 24 and 26 fully comply with the requirements of 35 U.S.C. § 112, first paragraph, and Appellants accordingly request the Examiner’s rejection be reversed.

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**B. Claims 11 and 17 – 21 define patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland (U.S. Patent No. 6,143,192) in view of Danielson, et al. (U.S. Patent No. 5,407,526).**

Appellants submit that the rejection of claims 11 and 17 – 21, based on 35 U.S.C. § 103(a), should be reversed because the Examiner has failed to establish *prima facie* obviousness. Appellants respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. *See* M.P.E.P. § 2143.

The Examiner does not show that all the elements of Appellants' claims are met in the cited references, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

*Prior Art Reference Must Teach or Suggest All the Claim Elements*

Appellants dispute the Examiner's contention that Westmoreland in view of Danielson teach or suggest each and every element of Appellants' claimed invention.

To begin, Appellants respectfully point out to that it "is *impermissible* within the framework of section 103 *to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary* to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *See In re Wesslau*, 147

U.S.P.Q. 391 (C.C.P.A. 1965), emphasis added. *See also* M.P.E.P. § 2141.02. Appellants submit that, for the reasons detailed below, the Examiner is only using so much of the cited references to support the Examiner's position, to the exclusion of other parts necessary to give a full appreciation of what the references fairly suggest to one of ordinary skill in the art.

Appellants' independent claim 17 recites, among other things,

“polishing method comprising: preparing a first polishing liquid containing tetravalent cerium ions in a first concentration; *adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... in a second concentration lower than the first concentration; polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate*” (italics added).

To explain how Appellants' claimed invention is distinguishable from Westmoreland and Danielson, Appellants raise the following points.

In contrast to the claimed elements of the present invention, Westmoreland discloses a “Ruthenium and Ruthenium Dioxide Removal Method and Material” (Westmoreland, Title). Westmoreland's preferred embodiment teaches that the material is “in the form of a liquid etchant solution” (col. 3, ll. 46 – 47), which “may be an aqueous solution wherein ceric ammonium nitrate, and, optionally, other solutes, are dissolved in liquid water” (col. 3, ll. 47 – 49).

The passages in Westmoreland relied upon by the Examiner to teach formation of the first and second solutions, specifically, Westmoreland, col. 3, ll. 42 – 49 and 55 – 57, merely disclose alternative embodiments of Westmoreland's invention and not the specifically recited two-solution system and polishing method of Appellants' claim 17. Westmoreland discloses



material that may be in the form of a liquid etchant solution where the solution "...may be an aqueous solution wherein ceric ammonium nitrate and optionally, other solutes, are dissolved in liquid water" (Westmoreland, col. 3, ll. 42 – 48). While Westmoreland also teaches that it "also provides for a slurry for use in planarization processes, including chemical mechanical planarization" (Westmoreland, col. 5, ll. 23 – 25), Westmoreland only refers to only one liquid etchant / slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

Westmoreland further discloses in one embodiment that the material of the invention "may include about 0.5 to about 70 weight percent ceric ammonium nitrate" (Westmoreland, col. 3, ll. 54 – 56). Contrary to the Examiner's assertion, this language merely further defines the concentration range of ceric ammonium nitrate in Westmoreland's material, and does not teach or suggest Appellants' claimed: "polishing method comprising ... adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 17).

As such, the Examiner's allegations have no factual basis. While Westmoreland's examples do, however, teach a single bath used for etching purposes ("Samples of ruthenium and ruthenium dioxide films ... were immersed in a room temperature ... bath of CR-14 Chrome Etchant" (Westmoreland, col. 7, l. 58 – col. 8, l. 1; and also disclosed generally in "Example 2" and "Example 3")), none of Westmoreland's exemplified embodiments teach or suggest all the claimed elements of Appellants' independent claim 17.

Westmoreland is clearly different from Appellants' invention, as claimed in independent claim 17. Simply providing a bath of commercially available "CR-14 Chrome Etchant



consist[ing] of 30% by weight ceric ammonium nitrate, 10% by weight acetic acid, and 60% by weight water” (Westmoreland, col. 8, ll. 3 –5), does not teach or suggest Appellants’ claimed:

“first polishing liquid containing tetravalent cerium ions in a first concentration; adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration,” “wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate” (claim 17).

Furthermore, Westmoreland does not teach or suggest an effective invention that can teach the elements of Ru – oxide removal. Westmoreland professes “[a] method for removing at least a portion of a structure, ... including ruthenium metal and/or ruthenium dioxide” (Westmoreland, Abstract), yet Westmoreland presents misleading information to one of ordinary skill in the art who should otherwise be enabled to make and use his invention. Appellants point to both “Example 2” and “Example 3,” wherein Westmoreland discloses “[n]o crystalline ruthenium dioxide was removed by the CR-14 Chrome Etchant” (col. 8, ll. 15 – 17), and “the annealed crystalline ruthenium dioxide film was not etched in the procedure” (col. 8, ll. 58 – 60).

As mentioned earlier in this Appeal Brief, noble metals or *conductive oxides of perovskite-type crystal structure* are chosen for the lower electrodes and dielectric films, *e.g., ruthenium (Ru) and Ru-compounds such as Ru-oxides*, particularly  $\text{SrRuO}_3$ . These materials are ideal for use in DRAMs and FRAMs. Westmoreland admits that crystalline Ru oxides are not removed by his single-step etch bath procedure utilizing a commercially-available Cr etchant. This also contrasts with Appellants’ invention, wherein “[a] typical example of the Ru compound that is to be polished in the present invention is  $\text{SrRuO}_3$ ” (Appellants’ specification, p. 8, ll. 4 – 5; see also Appellants’ claim 12, which will be discussed in the subsequent section),

where "SrRuO<sub>3</sub> is used in place of Ru for forming the lower electrode" (Appellants' specification, p. 18, ll. 5 – 6), and "a BaSrTiO<sub>3</sub> film 16 acting as a dielectric film is formed ... [and] annealed to form crystals of perovskite structure" (Appellants' specification, p. 19, ll. 7 – 12). Appellants note that SrRuO<sub>3</sub> also has a perovskite crystal structure, which lends itself to compatibility with the BaSrTiO<sub>3</sub> dielectric film (discussed earlier in the Summary of Invention). Appellants submit that, in addition to not teaching or suggesting at least each and every element of Appellants' claimed invention, Westmoreland does not effectively disclose an invention to solve crystalline Ru – oxide removal problems that are, in fact, solved by Appellants claimed polishing method.

Turning now to the Danielson reference, the Examiner did admit that "Westmoreland differs [from the present invention] in failing to explicitly teach the addition of the solvent is carried out upon or immediately before the polishing of said substrate, **in claim 17**" (Final Office Action, p. 4, bold in original). The Examiner then broadly alleged that "Danielson teaches a method of preparing an abrasive solution (polishing liquid), mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid..." (Final Office Action, p. 4). Appellants dispute this allegation, as Danielson's mixing produces only *one* polishing solution, and this is not equivalent to Appellants' claimed "adding a solvent for dilution to said first polishing liquid" (claim 17).

Danielson teaches that polishing is carried out after mixing of an abrasive solution and an oxidant solution. *See* Danielson, Abstract. The Examiner alleged that mixing of the abrasive solution and oxidant solution is equivalent to dilution of the abrasive solution ("mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid)" (Final Office Action, p. 4). Appellants submit that the Examiner's allegations are incorrect. Danielson's

oxidant solution, disclosed in column 4, lines 28 – 30, is a mixed solution of potassium ferricyanide and an acetate buffer, *and it is not a solvent for the abrasive solution.*

Moreover, Danielson does not cure the deficiencies of Westmoreland to allegedly produce Appellants' claimed invention. Danielson does not teach or suggest "Ru," "Ru compound," "cerium," or even "ions" anywhere in its disclosure. As such, when Danielson's "mixed slurry is delivered immediately to the polishing surface of the polishing pad" (column 5, lines 45 – 46), this is clearly different from Appellants' claimed "adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration" (claim 17). Therefore, the present invention, as recited in independent claim 17, cannot be attained based merely on Danielson's disclosure, taken alone or in combination with Westmoreland.

While the Examiner alleged "it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson's method" (Final Office Action, p. 5), Appellants have already demonstrated herein the impropriety of this combination, as both references do not teach or suggest all the elements of Appellants' independent claim 17, whether they are taken alone or combined together. Therefore, the Examiner's application of Westmoreland and Danielson as references does not satisfy the tenants of a proper 35 U.S.C. § 103(a) rejection. The Examiner has therefore not met an essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

*Suggestion or Motivation to Modify or Combine Reference Teachings*

The M.P.E.P. sets forth:

“However, “The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. *The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant’s specification, to make the necessary changes* in the reference device.” *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984).” M.P.E.P. § 2144.04, italics added.

As such, the present invention, as recited in independent claim 17, cannot be attained based merely on Westmoreland, or on a combination of Westmoreland and Danielson. Even though Appellants have already established that Westmoreland does not teach or suggest all the features of Appellants’ claimed invention, Appellants have demonstrated that the Examiner’s application of Danielson does not render the recitations of Appellants’ claims obvious.

Danielson, taken in combination with Westmoreland, still does not establish that there would have been the requisite suggestion or motivation in either reference to modify them to teach or suggest Appellants’ claimed invention. One skilled in the art would only arrive at the present claimed invention by consulting Appellants’ disclosure. Therefore, the only way to construct the claimed invention from the cited references would be to rely on aspects related to the present invention. Such reliance, however, would constitute improper hindsight reasoning.

There is no suggestion or motivation to modify Westmoreland or Danielson, *in either reference*, to produce Appellants’ claimed invention. Notwithstanding the Examiner’s characterization of the references, the requisite suggestion or motivation to modify them is still not established. “The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the

combination.” M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

As mentioned above, Westmoreland’s invention does not teach or suggest *any* of the recitations of Appellants’ independent claim 17, and Danielson’s teaching of mixing potassium ferricyanide and an acetate buffer with an abrasive, which is not a solvent for an abrasive solution, does not cure Westmoreland’s deficiencies. *These two disclosures diverge both in their aim and in their method of slurry application.* Because of this, their resultant combination cannot be obvious, since, for the reasons presented above, it still would not produce Appellants’ claimed invention.

As already demonstrated, such combination of these references *a priori* fails to establish obviousness of the claimed invention. Furthermore, Appellants have pointed out deficiencies in the cited prior art that render nugatory any indication that the cited references would give any motivation or reason to one of ordinary skill in the art to modify them *without the benefits of Appellants’ specification.* Therefore, Appellants submit that Westmoreland and Danielson do not suggest the desirability of any modification to result in Appellants’ claimed invention, since their combination still would not have produced Appellants’ present claimed invention.

Appellants remind the Examiner that determinations of *prima facie* obviousness must be supported by a finding of “substantial evidence.” See *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). Specifically, unless “substantial evidence” found in the record supports the factual determinations central to the issue of patentability, *including motivation*, the rejection is improper and should be withdrawn.

The Examiner did not provide any reason why one of ordinary skill in the art would have been motivated to combine the references, other than “for the purpose of creating of slurries

which give superior polish/etch rate (Danielson, column 2, lines 7-10)” (Final Office Action, p. 5).

In this case, Appellants submit that there is no “substantial evidence” in the record to support the combination of Westmoreland and Danielson, and the requisite “clear and particular” motivation required to support a *prima facie* case of obviousness is lacking. The Examiner merely provides an element-by-element analysis, attempting to point out where the references teach the individual elements, but fails to provide more than conclusory statements supporting a motive for achieving Appellants’ claimed combination. (See Final Office Action, pp. 4 – 5).

Therefore, in light of the deficiencies of Westmoreland and Danielson, discussed herein, Appellants submit that the Examiner points to no evidence supporting the notion that a skilled artisan having Westmoreland and Danielson before him/her would have been motivated to combine them to produce Appellants’ present claimed invention. For at least these reasons, the Examiner fails to meet the burden for establishing a *prima facie* case of obviousness.

*Reasonable Expectation of Success Required for Prima Facie Obviousness*

In addition, regarding the required reasonable expectation of success, as evidenced from previous arguments regarding Westmoreland’s and Danielson’s disclosures, Appellants submit that there would be no reasonable expectation of success to be derived from modifying these references, as this would diverge from the elements of Appellants’ claimed invention quoted previously. This also demonstrates that the Examiner’s reliance on Westmoreland and Danielson is not sufficient to establish *prima facie* obviousness. Basically, since these references, taken singly or together, would not have produced the claimed device of the present invention, they would not allow one of ordinary skill in the art to derive any reasonable expectation of success



from combining two references that, in combination, do not even produce the claimed elements of Appellants' invention.

Since Appellants have already demonstrated: (1) deficiencies in the cited references, (2) that they are not combinable to produce the present claimed invention, (3) that they teach away from the present invention, and (4) that they do not provide any suggestion or motivation to produce the present claimed invention, it logically flows that there would be no reasonable expectation of success expected by one of ordinary skill in the art when combining Westmoreland and Danielson.

Conclusion:

In summary, the Examiner has not met any of the essential criteria for establishing a *prima facie* case of obviousness. Appellants have demonstrated above that the Examiner: (a) has not shown that all recitations of Appellants' claimed invention are taught or suggested by Westmoreland and Danielson; (b) has not shown any requisite suggestion or motivation to modify Westmoreland and Danielson to produce Appellants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Westmoreland and Danielson in order to produce the present claimed invention. Thus, Appellants submit that the Examiner's reliance on these references fails to establish *prima facie* obviousness.

Finally, Appellants note that the M.P.E.P. sets forth that "[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03. Therefore, Appellants submit that independent claim 17 is allowable, for the reasons argued above. In addition, dependent claims 11, 18 – 21, and 23 (claim 23 being mentioned only in the body of the rejection, in passing, and not being explicitly rejected) are also allowable at least by virtue of their dependence from allowable base claim 17.

As such, “[i]n the absence of a proper *prima facie* case of obviousness, an Appellant who complies with the other statutory requirements is entitled to a patent. ... On appeal to the Board, an Appellant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness...” *In re Rouffet*, 47 USPQ2d 1453, 1455 (Fed. Cir. 1998).

For all the reasons advanced above, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection, and permit allowance of all the rejected claims.

**C. Claim 12 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, et al. (U.S. Patent No. 4,574,292).**

The rejection of dependent claim 12 under 35 U.S.C. § 103(a) as unpatentable over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, should be reversed, because the Examiner has failed to establish a *prima facie* case of obviousness.

Appellants disagree with the Examiner’s arguments and conclusions. The Examiner does not show that all the elements of Appellants’ claims are met in Westmoreland and/or Danielson, and does not show that there is any suggestion or motivation to modify the cited references with Takikawa to result in Appellants’ claimed invention. As previously discussed, “[t]o establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.” *See* M.P.E.P. § 2143.03, p. 2100-26.

A *prima facie* case of obviousness has not been made, since Appellants have already demonstrated that Westmoreland and Danielson, taken alone or in combination, fail to teach all of the features of independent claim 17. The Examiner has repeated, multiple times during



prosecution of the present application, that “Westmoreland in view of Danielson differs only in failing to teach the Ru compound is  $\text{SrRuO}_3$ ” (Final Office Action, p. 5) This statement, while only partially true, since Westmoreland and Danielson differ from Appellants’ invention *in many other ways* (such as those pointed out herein), still does not address the recitations of independent claim 17 that Westmoreland and Danielson fail to teach or suggest. These points were argued conclusively in the previous section, and are supplemented herein to challenge usage of the same arguments as applied to Takikawa.

Appellants contest the Examiner’s allegation that “it would have been obvious ... to modify Westmoreland in view of Danielson by using a Ru compound such as  $\text{SrRuO}_3$ ” (Final Office Action, p. 5). Appellants submit that the Examiner’s statement is an unsubstantiated generalization of questionable relevance to rejected claim 12. Appellants have already established, herein, that  $\text{SrRuO}_3$  has a perovskite crystal structure, and already established that Westmoreland admits not being able to etch crystalline Ru oxide compounds, of which  $\text{SrRuO}_3$  is an example. Appellants also established, herein, that Danielson does not even mention “Ru” or “ruthenium” anywhere in its disclosure. Thus, a combination of Westmoreland and Danielson on this point is improper.

Furthermore, the Examiner introduced Takikawa to allege that “the metal M in the metal oxide film containing Ru and a metal M ... provides a very stable structure of ...  $\text{RuSrO}_3$  (column 2, lines 39-45), which reads on a Ru compound is  $\text{SrRuO}_3$ ” (Final Office Action, p. 5). Appellants submit that whether or not Takikawa’s “metal M provides a very stable structure of  $\text{RuSrO}_3$ ” is irrelevant, *because Takikawa still does not cure the deficiencies of Westmoreland or Danielson*, as it does not teach or suggest the features of Appellants’ independent claim 17 not taught or suggested by Westmoreland or Danielson.

Appellants also submit that there is no motivation present *from within Takikawa* to combine it with Westmoreland or Danielson. Takikawa is directed "to a thermal head used in thermal character recording" (column 1, lines 6 – 7), and has nothing to do with Appellants' claimed polishing methods, or the polishing taught by Westmoreland and Danielson.

The present invention solves problems not addressed by Takikawa, and there is no motivation in Takikawa to modify it to solve the problems Appellants' have solved with the present invention, since Takikawa directs its attention to thermal character recording problems using thermal heads, which is not related in any way to Appellants' claimed polishing methods. Similarly, without any motivation with Takikawa to modify it, there can be no reasonable expectation of success from modifying Takikawa in combination with Westmoreland and/or Danielson to attempt somehow to produce Appellants' present invention.

The Examiner has therefore not met the essential criteria for establishing a *prima facie* case of obviousness. Appellants therefore submit that dependent claim 12 is allowable for the reasons presented herein, and at least by virtue of its dependence from base claim 17. Therefore, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection.

**D. Claim 22 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson.**

Appellants submit that the rejection of claim 22, based on 35 U.S.C. § 103(a), should be reversed because the Examiner has failed to establish *prima facie* obviousness. Appellants respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established.

The criteria for establishing *prima facie* obviousness have already been set forth. The Examiner does not show that all the elements of Appellants' claim 22 are met in the cited references, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

*Prior Art Reference Must Teach or Suggest All the Claim Elements*

Appellants dispute the Examiner's contention that Westmoreland in view of Danielson teach or suggest each and every element of Appellants' claimed invention.

To begin, Appellants respectfully point out to that it "*is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.*" See *In re Wesslau*, 147 U.S.P.Q. 391 (C.C.P.A. 1965), emphasis added. See also M.P.E.P. § 2141.02. Appellants submit that, for the reasons detailed below, the Examiner is only using so much of the cited references to support the Examiner's position, to the exclusion of other parts necessary to give a full appreciation of what the references fairly suggest to one of ordinary skill in the art.

Appellants' independent claim 22 recites, among other things,

"polishing method comprising: preparing a first polishing liquid containing cerium (IV) nitrate in a first concentration; *adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ...* in a second concentration lower than the first concentration; polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, *wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate*" (italics added).

To explain how Appellants' claimed invention is distinguishable from Westmoreland and Danielson, Appellants raise the following points.

In contrast to the claimed elements of the present invention, Westmoreland discloses a "Ruthenium and Ruthenium Dioxide Removal Method and Material" (Westmoreland, Title). Westmoreland's preferred embodiment teaches that the material is "in the form of a liquid etchant solution" (col. 3, ll. 46 – 47), which "may be an aqueous solution wherein ceric ammonium nitrate, and, optionally, other solutes, are dissolved in liquid water" (col. 3, ll. 47 – 49).

The passages in Westmoreland relied upon by the Examiner to teach formation of the first and second solutions, specifically, Westmoreland, col. 3, ll. 42 – 49 and 55 – 57, merely disclose alternative embodiments of Westmoreland's invention and not the specifically recited two-solution system and polishing method of Appellants' claim 22. Westmoreland discloses material that may be in the form of a liquid etchant solution where the solution "...may be an aqueous solution wherein ceric ammonium nitrate and optionally, other solutes, are dissolved in liquid water" (Westmoreland, col. 3, ll. 42 – 48). While Westmoreland also teaches that it "also provides for a slurry for use in planarization processes, including chemical mechanical planarization" (Westmoreland, col. 5, ll. 23 – 25), Westmoreland refers to only one liquid etchant / slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

Westmoreland further discloses in one embodiment that the material of the invention "may include about 0.5 to about 70 weight percent ceric ammonium nitrate" (Westmoreland, col. 3, ll. 54 – 56). Contrary to the Examiner's assertion, this language merely further defines the

concentration range of ceric ammonium nitrate in Westmoreland's material, and does not teach or suggest Appellants' claimed: "polishing method comprising ... adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 22).

As such, the Examiner's allegations have no factual basis. While Westmoreland's examples do, however, teach a single bath used for etching purposes ("Samples of ruthenium and ruthenium dioxide films ... were immersed in a room temperature ... bath of CR-14 Chrome Etchant" (Westmoreland, col. 7, l. 58 – col. 8, l. 1; and also disclosed generally in "Example 2" and "Example 3")), none of Westmoreland's exemplary embodiments teach or suggest all the claimed elements of Appellants' independent claim 22.

Westmoreland is clearly different from Appellants' invention, as claimed in independent claim 17. Simply providing a bath of commercially available "CR-14 Chrome Etchant consist[ing] of 30% by weight ceric ammonium nitrate, 10% by weight acetic acid, and 60% by weight water" (Westmoreland, col. 8, ll. 3 – 5), does not teach or suggest Appellants' claimed:

"first polishing liquid containing cerium (IV) nitrate in a first concentration; adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration," "wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 22).

Furthermore, Westmoreland does not teach or suggest an effective invention that can teach the elements of Ru – oxide removal. Westmoreland professes "[a] method for removing at least a portion of a structure, ... including ruthenium metal and/or ruthenium dioxide" (Westmoreland, Abstract), yet Westmoreland presents misleading information to one of ordinary

skill in the art who should otherwise be enabled to make and use his invention. Appellants point to both “Example 2” and “Example 3,” wherein Westmoreland discloses “[n]o crystalline ruthenium dioxide was removed by the CR-14 Chrome Etchant” (col. 8, ll. 15 – 17), and “the annealed crystalline ruthenium dioxide film was not etched in the procedure” (col. 8, ll. 58 – 60).

As mentioned earlier in this Appeal Brief, noble metals or *conductive oxides of perovskite-type crystal structure* are chosen for the lower electrodes and dielectric films, *e.g. ruthenium (Ru) and Ru-compounds such as Ru-oxides*, particularly  $\text{SrRuO}_3$ . These materials are ideal for use in DRAMs and FRAMs. Westmoreland admits that crystalline Ru oxides are not removed by his single-step etch bath procedure utilizing a commercially-available Cr etchant. This also contrasts with Appellants’ invention, wherein “[a] typical example of the Ru compound that is to be polished in the present invention is  $\text{SrRuO}_3$ ” (Appellants’ specification, p. 8, ll. 4 – 5; see also Appellants’ claim 12, which will be discussed in the subsequent section), where “ $\text{SrRuO}_3$  is used in place of Ru for forming the lower electrode” (Appellants’ specification, p. 18, ll. 5 – 6), and “a  $\text{BaSrTiO}_3$  film 16 acting as a dielectric film is formed ... [and] annealed to form crystals of perovskite structure” (Appellants’ specification, p. 19, ll. 7 – 12). Appellants note that  $\text{SrRuO}_3$  also has a perovskite crystal structure, which lends itself to compatibility with the  $\text{BaSrTiO}_3$  dielectric film (discussed earlier in the Summary of Invention). Appellants submit that, in addition to not teaching or suggesting each and every element of Appellants’ claimed invention, Westmoreland does not effectively disclose or suggest an approach to solve crystalline Ru – oxide removal problems that are, in fact, solved by Appellants claimed polishing method.

Turning now to the Danielson reference, the Examiner did admit that “Westmoreland differs [from the present invention] in failing to explicitly teach the addition of the solvent is carried out upon or immediately before the polishing of said substrate” (Final Office Action,



p. 7). The Examiner then broadly alleged that "Danielson teaches a method of preparing an abrasive solution (polishing liquid), mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid..." (Final Office Action, p. 7). Appellants dispute this allegation, as Danielson's mixing produces only *one* polishing solution, and this is not equivalent to, or compatible with, Appellants' claimed "adding a solvent for dilution to said first polishing liquid" (claim 22).

Danielson teaches that polishing is carried out after mixing of an abrasive solution and an oxidant solution. *See* Danielson, Abstract. The Examiner alleged that mixing of the abrasive solution and oxidant solution is equivalent to dilution of the abrasive solution ("mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid)" (Final Office Action, p. 7). Appellants submit that the Examiner's allegations are incorrect. Danielson's oxidant solution, disclosed in column 4, lines 28 – 30, is a mixed solution of potassium ferricyanide and an acetate buffer, *and it is not a solvent for the abrasive solution.*

Moreover, Danielson does not cure the deficiencies of Westmoreland to allegedly produce Appellants' claimed invention. Danielson does not teach or suggest "Ru," "Ru compound," "cerium," or even "ions" anywhere in its disclosure. As such, when Danielson's "mixed slurry is delivered immediately to the polishing surface of the polishing pad" (column 5, lines 45 – 46), this is clearly different from Appellants' claimed "addition of the solvent to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration" (claim 22). Therefore, the present invention, as recited in independent claim 22, cannot be attained based merely on Danielson's disclosure, taken alone or in combination with Westmoreland.

While the Examiner alleged "it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson's method" (Final Office Action, p. 7), Appellants have already demonstrated herein the impropriety of this combination, as both references do not teach or suggest all the elements of Appellants' independent claim 22, whether they are taken alone or combined together. Therefore, the Examiner's application of Westmoreland and Danielson as references does not satisfy the tenants of a proper 35 U.S.C. § 103(a) rejection. The Examiner has therefore not met an essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

*Suggestion or Motivation to Modify or Combine Reference Teachings*

The M.P.E.P. sets forth:

"However, "The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. *The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes in the reference device.*" *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984)." M.P.E.P. § 2144.04, italics added.

As such, the present invention, as recited in independent claim 22, cannot be attained based merely on Westmoreland, or on a combination of Westmoreland and Danielson.

Appellants have already established that Westmoreland does not teach or suggest all the features of Appellants' claimed invention. Appellants have also demonstrated that the Examiner's application of Danielson does not render the recitations of Appellants' claims obvious.



Danielson, taken in combination with Westmoreland, still does not establish that there would have been the requisite suggestion or motivation in either reference to modify them to teach or suggest Appellants' claimed invention. One skilled in the art would only arrive at the present claimed invention by consulting Appellants' disclosure. Therefore, the only way to construct the claimed invention from the cited references would be to rely on aspects related to the present invention. Such reliance, however, would constitute improper hindsight reasoning.

There is no suggestion or motivation to modify Westmoreland or Danielson, *in either reference*, to produce Appellants' claimed invention. Even the Examiner's characterization of the references still does not establish that there would have been the requisite suggestion or motivation to modify them. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

As mentioned above, Westmoreland's invention does not teach or suggest *any* of the recitations of Appellants' independent claim 22, and Danielson's teaching of mixing potassium ferricyanide and an acetate buffer with an abrasive, which is not a solvent for an abrasive solution, does not cure Westmoreland's deficiencies. *These two disclosures diverge both in their aim and in their method of slurry application*. Because of this, their resultant combination cannot be obvious, since, for the reasons presented above, it still does not produce Appellants' claimed invention.

As already demonstrated, such combination of these references *a priori* fails to establish obviousness of the claimed invention. Furthermore, Appellants have pointed out deficiencies in the cited prior art that render nugatory any indication that the cited references would give any

motivation or reason to one of ordinary skill in the art to modify them *without the benefits of Appellants' specification*. Therefore, Appellants submit that Westmoreland and Danielson do not suggest the desirability of any modification to result in Appellants' claimed invention, since their combination still does not produce Appellants' present claimed invention.

Appellants remind the Examiner that determinations of *prima facie* obviousness must be supported by a finding of "substantial evidence." *See In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). Specifically, unless "substantial evidence" found in the record supports the factual determinations central to the issue of patentability, *including motivation*, the rejection is improper and should be withdrawn.

The Examiner did not provide any reason why one of ordinary skill in the art would have been motivated to combine the references, other than "for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10)" (Final Office Action, p. 8).

In this case, Appellants submit that there is no "substantial evidence" in the record to support the combination of Westmoreland and Danielson, and the requisite "clear and particular" motivation required to support a *prima facie* case of obviousness is lacking. The Examiner merely provides an element-by-element analysis, attempting to point out where the references teach the individual elements, but fails to provide more than conclusory statements supporting a motive for achieving Appellants' claimed combination. (*See* Final Office Action, pp. 7 – 8).

Therefore, in light of the deficiencies of Westmoreland and Danielson, discussed herein, Appellants submit that the Examiner points to no evidence supporting the notion that a skilled artisan having Westmoreland and Danielson before him/her would have been motivated to

combine them to produce Appellants' present claimed invention. For at least these reasons, the Examiner fails to meet the burden for establishing a *prima facie* case of obviousness.

Reasonable Expectation of Success Required for Prima Facie Obviousness

In addition, regarding the required reasonable expectation of success, as evidenced from previous arguments regarding Westmoreland's and Danielson's disclosures, Appellants submit that there would be no reasonable expectation of success to be derived from modifying these references, as this would diverge from the elements of Appellants' claimed invention, quoted previously. This also demonstrates that the Examiner's reliance on Westmoreland and Danielson is not sufficient to establish *prima facie* obviousness. Basically, since these references, taken singly or together, would not have produced the claimed device of the present invention, they would not allow one of ordinary skill in the art to derive any reasonable expectation of success from combining two references that, in combination, do not even produce the claimed elements of Appellants' invention.

Since Appellants have already demonstrated: (1) deficiencies in the cited references, (2) that they are not combinable to produce the present claimed invention, (3) that they teach away from the present invention, and (4) that they do not provide any suggestion or motivation to produce the present claimed invention, it logically flows that there would be no reasonable expectation of success expected by one of ordinary skill in the art when combining Westmoreland and Danielson.

Conclusion:

In summary, the Examiner has not met any of the essential criteria for establishing a *prima facie* case of obviousness. Appellants have demonstrated above that the Examiner: (a) has not shown that all recitations of Appellants' claimed invention are taught or suggested by

Westmoreland and Danielson; (b) has not shown any requisite suggestion or motivation to modify Westmoreland and Danielson to produce Appellants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Westmoreland and Danielson in order to produce the present claimed invention. Thus, Appellants submit that the Examiner's reliance on these references fails to establish *prima facie* obviousness.

Finally, Appellants note that the M.P.E.P. sets forth that "[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03. Therefore, Appellants submit that independent claim 22 is allowable, for the reasons argued above. In addition, dependent claim 25 (claim 25 being mentioned only in the body of the rejection, in passing, and not being explicitly rejected) is also allowable at least by virtue of its dependence from allowable base claim 22.

As such, "[i]n the absence of a proper *prima facie* case of obviousness, an Appellant who complies with the other statutory requirements is entitled to a patent. ... On appeal to the Board, an Appellant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness..." *In re Rouffet*, 47 USPQ2d 1453, 1455 (Fed. Cir. 1998).

For all the reasons advanced above, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection, and permit allowance of all the rejected claims.

In making various references to the specification and drawings set forth herein, it is understood that Appellants are in no way intending to limit the scope of the claims to the exemplary embodiments described in the specification and illustrated in the drawings. Rather, Appellants expressly affirm that they are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

For all the reasons advanced above in the previous sections, the Board should reverse the rejections under 35 U.S.C. § 112, first paragraph, and 35 U.S.C. § 103(a), and permit allowance of all the rejected claims.

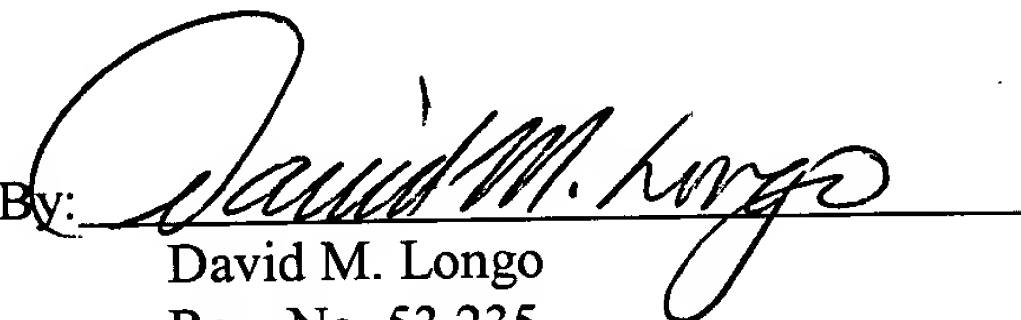
**IX. Appendix**

Attached Appendix A contains a clean copy of claims 11, 12, and 17 – 26 involved in this appeal. Please grant any extensions of time required to enter this Appeal Brief and charge any additional fees required to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,  
GARRETT & DUNNER, L.L.P.

Dated: October 20, 2003

By:   
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**“APPENDIX A” TO APPEAL BRIEF OF October 20, 2003**

11. A polishing method according to claim 17, wherein said second polishing liquid does not contain abrasive grains.

12. A polishing method according to claim 17, wherein said Ru compound is  $\text{SrRuO}_3$ .

17. A polishing method comprising:

preparing a first polishing liquid containing tetravalent cerium ions in a first concentration;

adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration;

polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid,

wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate.

18. A polishing method according to claim 17, wherein said second polishing liquid contains cerium (IV) nitrate in a concentration of 0.75% or more by weight.

19. A polishing method according to claim 18, wherein said second polishing liquid contains cerium (IV) nitrate in a concentration of 0.75 to 2% by weight.

20. A polishing method according to claim 17, wherein said second polishing liquid contains diammonium cerium (IV) nitrate in a concentration of 3% or more by weight.

21. A polishing method according to claim 20, wherein said second polishing liquid contains diammonium cerium (IV) nitrate in a concentration of 3 to 8% by weight.

22. A polishing method comprising:  
preparing a first polishing liquid containing cerium (IV) nitrate in a first concentration;  
adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration;  
polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid,  
wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate.

23. A polishing method according to claim 17, wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute.

24. A polishing method according to claim 17, wherein said solvent consists essentially of water.

25. A polishing method according to claim 22, wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute.

26. A polishing method according to claim 22, wherein said solvent consists essentially of water.



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**I. Real Party in Interest**

The real party in interest is Kabushiki Kaisha Toshiba, a corporation of Japan, by virtue of an assignment that was recorded on December 2, 1999, at Reel 010432, starting at Frame 0017.

**II. Related Appeals and Interferences**

There are currently no known Appeals or Interferences related to this application that are awaiting decision by the Board of Patent Appeals and Interferences. An Appeal Brief was filed on August 5, 2002, but prosecution was reopened with a nonfinal Office Action on December 12, 2002. An Amendment was filed on March 11, 2003, and a Final Office Action was issued on May 20, 2003, to which this Appeal Brief is addressed.

**III. Status Of Claims**

Claims 11 – 26 are pending for the purposes of this Appeal Brief, with claims 13 – 16 withdrawn from consideration as drawn to a nonelected invention, Appellants having traversed the restriction requirement in the Amendment filed on November 8, 2001 in paper No. 5. For the purposes of this Appeal Brief, claims 24 and 26 have been rejected under 35 U.S.C. § 112, first paragraph; claims 11 and 17 – 21 have been rejected under 35 U.S.C. § 103(a); claim 12 has been rejected under 35 U.S.C. § 103(a); and claim 22 has been rejected under 35 U.S.C. § 103(a). Claims 23 and 25 were not listed as rejected in the Final Office Action. Claims 11, 12, and 17 – 26, on appeal, are set forth in an attachment entitled “Appendix A.”

**IV. Status Of Amendments**

Appellants filed an Amendment on March 11, 2003. In a Final Office Action, dated May 20, 2003, the Examiner repeated the rejections of claims 11, 12, and 17 – 22, added a rejection of claims 24 and 26, and did not explicitly reject claims 23 and 25. Claims 23 and 25

were only mentioned in passing, in the body of the rejection of claims 11 and 17 – 21 (claim 23), and in the rejection of claim 22 (claim 25). The claims have been amended during prosecution of the present application, and all amendments submitted have been entered.

**V. Summary Of Invention**

The present invention relates to a polishing method useful in chemical mechanical polishing (“CMP”), comprising preparation of a first polishing liquid containing tetravalent cerium ions (or cerium (IV) nitrate) in a first concentration; adding a solvent to the first polishing liquid to form a second polishing liquid containing tetravalent cerium ions (or cerium (IV) nitrate) in a second concentration lower than the first concentration, followed by polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, wherein the addition of the solvent is carried out upon, or immediately before, the polishing of said substrate. (*See Appellants’ claims 17 and 22, for example.*)

As semiconductor device component dimensions continue to decrease, thereby enabling denser packing of integrated circuits (“ICs”) on wafers, CMP has emerged as a fundamentally necessary tool for modern IC fabrication. CMP is used to polish and flatten wafer surfaces between processing steps to eliminate unwanted material from the surface of a partially fabricated device, which in turn prepares the surface for subsequent processing steps (such as film deposition, etc.).

CMP utilizes a polishing liquid or slurry between the surface to be modified and a rotating pad or disk. A range of polishing liquids are available, and these liquids contain materials designed to chemically and mechanically “attack” the surface to which they are applied. This combination of chemical and mechanical removal of material results in a highly-efficient surface preparation technique.

Surfaces prepared by CMP are extremely flat, which is ideal for modern IC fabrication. This contrasts with conventional wet etching and dry etching technologies, which may not produce a flat or even surface in a reproducible manner. While wet etching and dry etching technologies are useful in certain aspects of IC fabrication, CMP is used to remove unwanted material in a highly-controlled and reproducible manner.

Processing during the fabrication of dynamic random access memory ("DRAM") chips and next-generation nonvolatile ferroelectric random access memory ("FRAM") chips includes formation of dielectric films that are compatible with lower electrode materials. Compatibility is judged in part by low lattice mismatch at the atomic-scale interface between the materials, wherein low lattice mismatch reduces interfacial strain and also improves adhesion of deposited film layers. To improve this interface compatibility, materials with similar crystal structures are selected for different layers in a given device, e.g., for the interface between an electrode layer and a dielectric layer. Noble metals or conductive oxides of perovskite-type crystal structure are preferred for the lower electrodes and dielectric films, e.g., ruthenium (Ru) and Ru-compounds such as Ru-oxides, particularly  $\text{SrRuO}_3$ . These materials, however, are chemically stable in general and therefore ideal for use in DRAMs and FRAMs, but this makes it difficult to employ standard processing techniques (i.e., wet etching or dry etching, mentioned earlier) for fabrication of lower electrodes and dielectric films. (Specification, p. 1, l. 18 – p. 2, l. 5). Since wet etching or dry etching may not produce flat surfaces reproducibly when applied to noble metals or conductive oxides of perovskite-type crystal structure, CMP is ideal for processing these materials in a reproducible manner.

Exemplary processing steps are illustrated, for example, in Appellants' specification, Figs. 2A – 2C, wherein CMP is shown being used to prepare a  $\text{SrRuO}_3$  lower electrode 15 in a

patterned region of  $\text{SiO}_2$  stopper film 13 to prepare the surfaces of these materials for deposition of a  $\text{BaSrTiO}_3$  dielectric film. (*See also* Specification, p. 18, l. 10 – p. 19, l. 22).

Effectiveness of CMP is aided by the choice of polishing liquid or slurry. Conventional polishing liquids are defective for CMP surface preparation of noble metals or conductive oxides of perovskite-type crystal structure, in that the polishing rate is low. Low polishing rates result in low manufacturing efficiency. Furthermore, conventional polishing liquids do not distinguish between these new materials during polishing, e.g., between lower electrode materials (e.g.,  $\text{SrRuO}_3$ ) and those materials used as “stopper films” (e.g.,  $\text{SiO}_2$ ) (to indicate a certain depth of polishing). This low selectivity between material types makes it difficult to obtain a uniform and stable processed surface during CMP. (Specification, p. 2, ll. 12 – 20).

The present invention solves these problems by providing a polishing method that effects a high polishing rate and a high selectivity ratio relative to the underlying film layers, in situations where noble metals or conductive oxides of perovskite-type crystal structure are polished using CMP, particularly for Ru and Ru-compounds such as  $\text{SrRuO}_3$ .

**VI. Issues**

**A. Whether claims 24 and 26 define patentable subject matter under 35 U.S.C. § 112, first paragraph.**

**B. Whether claims 11 and 17 – 21 define patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland (U.S. Patent No. 6,143,192) in view of Danielson, et al. (U.S. Patent No. 5,407,526).**

**C. Whether claim 12 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, et al. (U.S. Patent No. 4,574,292).**

**D. Whether claim 22 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson.**

**VII. Grouping Of Claims**

All of the claims, at issue in “Section VI” above, do not stand or fall together.

1. Regarding the rejection under 35 U.S.C. § 112, first paragraph, claim 24 stands alone and claim 26 stands alone.

2. Regarding the rejections under 35 U.S.C. § 103(a), claims 11 and 17 – 21 stand together, claim 22 stands alone, and claim 12 stands alone as dependent from base claim 17.

3. Claims 23 and 25 each stand alone, as they were incorporated into the body of the rejection of claims 11 and 17 – 21, and the body of the rejection of claim 22, but not explicitly rejected or objected to in the Final Office Action of May 20, 2003.

**VIII. Argument**

**A. Claims 24 and 26 define patentable subject matter under 35 U.S.C. § 112, first paragraph.**

The Examiner rejected claims 24 and 26 under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the written description requirement. The Examiner alleged that “[t]he claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the

application was filed, had possession of the claimed invention.” (Final Office Action, p. 2). The Examiner failed to substantiate this allegation. Instead, the Examiner quoted a portion of Appellants’ claims 24 and 26, which recite, *inter alia*, “wherein said solvent consists essentially of water.” Id. The Examiner then quotes M.P.E.P. § 2163(II)(A)(1), 8th Ed. (Rev. Feb. 2003), p. 2100-63, without citation, to allege that Appellant “has the burden of showing that the introduction of additional steps or components would materially change the characteristics of [Appellants’] invention” (Final Office Action, p. 2, and M.P.E.P. § 2163(II)(A)(1)), presumably because a “consisting essentially of” claim occupies a middle ground between closed claims that are written in a ‘consisting of’ format and fully open claims that are drafted in a ‘comprising’ format.” *PPG Industries v. Guardian Industries*, 156 F.3d 1351, 1354, 48 USPQ2d 1351, 1353-54 (Fed. Cir. 1998).” Id.

1. The Examiner has not presented any evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims.

The M.P.E.P. instructs that

“*The examiner has the initial burden, after a thorough reading and evaluation of the content of the application, of presenting evidence or reasons why a person skilled in the art would not recognize that the written description of the invention provides support for the claims.* There is a strong presumption that an adequate written description of the claimed invention is present in the specification as filed, *Wertheim*, 541 F.2d at 262, 191 USPQ at 96...” M.P.E.P. § 2163(II)(A), p. 2100-163, italics added.

Appellants submit that the Examiner has not presented any such evidence or reasons to Appellants in the Final Office Action, absent only a blanket allegation that “[in claims 24 and



26] “wherein said solvent consists essentially of water” is not supported by the Specification” (Final Office Action, p. 2).

The M.P.E.P. goes on to say “however, with respect to newly added or amended claims, [Appellant] should show support in the original disclosure for the new or amended claims.” M.P.E.P. § 2163(II)(A)(1), p. 2100-163. To make this point abundantly clear, Appellants respectfully direct the Board’s attention to the specification, p. 5, lines 16 – 23 (“the polishing liquid ... is prepared by dissolving cerium (IV) nitrate in a solvent... Of course, an aqueous solution of cerium (IV) nitrate and an aqueous solution of diammonium cerium (IV) nitrate can be used as effective polishing liquids in the present invention”), p. 7, lines 11 – 17 (“polishing liquid ... which was prepared by diluting with water an aqueous solution containing 20% by weight of diammonium cerium (IV) nitrate”), p. 9, lines 12 – 15, p. 11, lines 8 – 11, and p. 13, lines 9 – 13 (“a polishing liquid prepared by adding diammonium cerium nitrate to a dispersion prepared by dispersing alumina particles ... in water”), p. 18, line 27 to p. 19, line 2 (“An aqueous solution containing 1% by weight (or 1 to 2% by weight) of diammonium cerium nitrate is used as the polishing liquid”), and p. 20, lines 18 – 21 and p. 22, lines 16 – 20 (“An aqueous solution containing 1% by weight (or 1 to 2% by weight) of diammonium cerium nitrate, which does not contain abrasive grains, is used as the polishing liquid”).

Having demonstrated that Appellants’ specification *does* contain subject matter described in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention, Appellants point out that

“[a] description as filed is presumed to be adequate, unless or until sufficient evidence or reasoning to the contrary has been presented by the examiner to rebut the presumption. See, e.g., *In re Marzocchi*, 439 F.2d 220, 224,

169 USPQ 367, 370 (CCPA 1971). *The examiner, therefore, must have a reasonable basis to challenge the adequacy of the written description. The examiner has the initial burden of presenting by a preponderance of evidence why a person skilled in the art would not recognize in an applicant's disclosure a description of the invention defined by the claims. Wertheim, 541 F.2d at 263, 191 USPQ at 97.*" M.P.E.P. § 2163.04, p. 2100-173, italics added.

Appellants submit that the Examiner has not (a) presented sufficient evidence or reasoning to the contrary, or (b) presented by a preponderance of evidence why a person skilled in the art would not recognize in an Appellants' disclosure a description of the invention defined by the claims at issue.

2. *The Examiner has not determined what the claim, as a whole, covers.*

The Examiner quotes M.P.E.P. § 2163(II)(A)(1), without citation, to point to the use of the phrase "consisting essentially of" in Appellants' claims 24 and 26, and to allege that Appellant "has the burden of showing that the introduction of additional steps or components would materially change the characteristics of [Appellants'] invention" (Final Office Action, p. 2, and M.P.E.P. § 2163(II)(A)(1)).

In response, Appellants note that the Examiner has quoted the M.P.E.P. in such a way that obfuscates the context of its discussion regarding transitional phrases in claim language, and, as such, inadvertently ignores the requirement that "[e]ach claim must be separately analyzed and given its broadest reasonable interpretation in light of and consistent with the written description. See, e.g., *In re Morris*, 127 F.3d 1048, 1053-54, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997). *The entire claim must be considered*, including the preamble language and the transitional phrase." M.P.E.P. § 2163(II)(A)(1), italics added.

Directly before the quote cited by the Examiner, the M.P.E.P. points out that “[b]y using the term 'consisting essentially of,' the drafter signals that the invention necessarily includes the listed ingredients and is open to unlisted ingredients that do not materially affect the basic and novel properties of the invention.” *Id.*, internal citation omitted. Furthermore, directly after the quote cited by the Examiner, the M.P.E.P. goes on to say that “absent a clear indication in the specification or claims of what the basic and novel characteristics actually are, "consisting essentially of" will be construed as equivalent to "comprising.”” *Id.*, internal citation omitted.

Contrary to the Examiner’s allegation, only if

“an applicant contends that additional steps or materials in the prior art are excluded by the recitation of "consisting essentially of," applicant has the burden of showing that the introduction of additional steps or components would materially change the characteristics of applicant's invention. *In re De Lajarte*, 337 F.2d 870, 143 USPQ 256 (CCPA 1964). See also MPEP § 2111.03.” *Id.* at 2100-164.

Appellant has not contended before the Examiner that additional steps or materials in the prior art are excluded by the recitation of “consisting essentially of.” As evident from the eight citations to the specification above to show support for the recited elements of claims 24 and 26, Appellants submit that they have shown “possession of the claimed invention by describing the claimed invention with all of its limitations. *Lockwood*, 107 F.3d at 1572, 41 USPQ2d at 1966.” *Id.* Furthermore, under this rubric, Appellants submit that “[t]he absence of definitions or details for well-established terms or procedures should not be the basis of a rejection under 35 U.S.C. § 112, para. 1, for lack of adequate written description.” *Id.*

Appellants therefore submit that the claimed phrase, “wherein said solvent consists essentially of water,” fully complies with the written description requirement of 35 U.S.C. § 112,

first paragraph, and that this claim element is “expressly, implicitly, or inherently supported in the originally filed disclosure.” M.P.E.P. § 2163(II)(A)(3)(b), p. 2100-169.

Since “[t]he fundamental factual inquiry is whether the specification conveys with reasonable clarity to those skilled in the art that, as of the filing date sought, applicant was in possession of the invention as now claimed. See, e.g., *Vas-Cath, Inc.*, 935 F.2d at 1563-64, 19 USPQ2d at 1117” (M.P.E.P. § 2163(I)(B), p. 2100-163), this rejection should be overturned at least for the reasons presented above, including the eight citations to Appellants’ specification showing support for claims 24 and 26.

Appellants submit that the rejection of claims 24 and 26 under 35 U.S.C. § 112, first paragraph, should be reversed, because Appellants’ subject matter has a complete and clear description in the specification in such a way as to convey to one of ordinary skill in the art that Appellants had possession of the claimed invention at the time the application was filed. The language of claims 24 and 26 clearly complies with the written description requirement. Appellants submit that all subject matter in “the specification conveys with a reasonable clarity to those skilled in the art that, as of the filing date sought, [Appellants were] in possession of the invention as now claimed” (M.P.E.P. § 2163), and that Appellants have fully satisfied their burden to “show support in the original disclosure for the new or amended claims” (*Id.*).

Claims 24 and 26 fully comply with the requirements of 35 U.S.C. § 112, first paragraph, and Appellants accordingly request the Examiner’s rejection be reversed.

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**B. Claims 11 and 17 – 21 define patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland (U.S. Patent No. 6,143,192) in view of Danielson, et al. (U.S. Patent No. 5,407,526).**

Appellants submit that the rejection of claims 11 and 17 – 21, based on 35 U.S.C. § 103(a), should be reversed because the Examiner has failed to establish *prima facie* obviousness. Appellants respectfully disagree with the Examiner's arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, the prior art reference (or references when combined) must teach or suggest all the claim elements. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify a reference or to combine reference teachings. Third, there must be a reasonable expectation of success. *See* M.P.E.P. § 2143.

The Examiner does not show that all the elements of Appellants' claims are met in the cited references, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

*Prior Art Reference Must Teach or Suggest All the Claim Elements*

Appellants dispute the Examiner's contention that Westmoreland in view of Danielson teach or suggest each and every element of Appellants' claimed invention.

To begin, Appellants respectfully point out to that it "is *impermissible* within the framework of section 103 *to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.*" *See In re Wesslau*, 147

U.S.P.Q. 391 (C.C.P.A. 1965), emphasis added. *See also* M.P.E.P. § 2141.02. Appellants submit that, for the reasons detailed below, the Examiner is only using so much of the cited references to support the Examiner's position, to the exclusion of other parts necessary to give a full appreciation of what the references fairly suggest to one of ordinary skill in the art.

Appellants' independent claim 17 recites, among other things,

“polishing method comprising: preparing a first polishing liquid containing tetravalent cerium ions in a first concentration; *adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... in a second concentration lower than the first concentration; polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate*” (italics added).

To explain how Appellants' claimed invention is distinguishable from Westmoreland and Danielson, Appellants raise the following points.

In contrast to the claimed elements of the present invention, Westmoreland discloses a “Ruthenium and Ruthenium Dioxide Removal Method and Material” (Westmoreland, Title). Westmoreland's preferred embodiment teaches that the material is “in the form of a liquid etchant solution” (col. 3, ll. 46 – 47), which “may be an aqueous solution wherein ceric ammonium nitrate, and, optionally, other solutes, are dissolved in liquid water” (col. 3, ll. 47 – 49).

The passages in Westmoreland relied upon by the Examiner to teach formation of the first and second solutions, specifically, Westmoreland, col. 3, ll. 42 – 49 and 55 – 57, merely disclose alternative embodiments of Westmoreland's invention and not the specifically recited two-solution system and polishing method of Appellants' claim 17. Westmoreland discloses

material that may be in the form of a liquid etchant solution where the solution "...may be an aqueous solution wherein ceric ammonium nitrate and optionally, other solutes, are dissolved in liquid water" (Westmoreland, col. 3, ll. 42 – 48). While Westmoreland also teaches that it "also provides for a slurry for use in planarization processes, including chemical mechanical planarization" (Westmoreland, col. 5, ll. 23 – 25), Westmoreland only refers to only one liquid etchant / slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

Westmoreland further discloses in one embodiment that the material of the invention "may include about 0.5 to about 70 weight percent ceric ammonium nitrate" (Westmoreland, col. 3, ll. 54 – 56). Contrary to the Examiner's assertion, this language merely further defines the concentration range of ceric ammonium nitrate in Westmoreland's material, and does not teach or suggest Appellants' claimed: "polishing method comprising ... adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 17).

As such, the Examiner's allegations have no factual basis. While Westmoreland's examples do, however, teach a single bath used for etching purposes ("Samples of ruthenium and ruthenium dioxide films ... were immersed in a room temperature ... bath of CR-14 Chrome Etchant" (Westmoreland, col. 7, l. 58 – col. 8, l. 1; and also disclosed generally in "Example 2" and "Example 3")), none of Westmoreland's exemplified embodiments teach or suggest all the claimed elements of Appellants' independent claim 17.

Westmoreland is clearly different from Appellants' invention, as claimed in independent claim 17. Simply providing a bath of commercially available "CR-14 Chrome Etchant



consist[ing] of 30% by weight ceric ammonium nitrate, 10% by weight acetic acid, and 60% by weight water” (Westmoreland, col. 8, ll. 3 – 5), does not teach or suggest Appellants’ claimed:

“first polishing liquid containing tetravalent cerium ions in a first concentration; adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration,” “wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate” (claim 17).

Furthermore, Westmoreland does not teach or suggest an effective invention that can teach the elements of Ru – oxide removal. Westmoreland professes “[a] method for removing at least a portion of a structure, ... including ruthenium metal and/or ruthenium dioxide” (Westmoreland, Abstract), yet Westmoreland presents misleading information to one of ordinary skill in the art who should otherwise be enabled to make and use his invention. Appellants point to both “Example 2” and “Example 3,” wherein Westmoreland discloses “[n]o crystalline ruthenium dioxide was removed by the CR-14 Chrome Etchant” (col. 8, ll. 15 – 17), and “the annealed crystalline ruthenium dioxide film was not etched in the procedure” (col. 8, ll. 58 – 60).

As mentioned earlier in this Appeal Brief, noble metals or *conductive oxides of perovskite-type crystal structure* are chosen for the lower electrodes and dielectric films, *e.g., ruthenium (Ru) and Ru-compounds such as Ru-oxides*, particularly  $\text{SrRuO}_3$ . These materials are ideal for use in DRAMs and FRAMs. Westmoreland admits that crystalline Ru oxides are not removed by his single-step etch bath procedure utilizing a commercially-available Cr etchant. This also contrasts with Appellants’ invention, wherein “[a] typical example of the Ru compound that is to be polished in the present invention is  $\text{SrRuO}_3$ ” (Appellants’ specification, p. 8, ll. 4 – 5; see also Appellants’ claim 12, which will be discussed in the subsequent section),

where “SrRuO<sub>3</sub> is used in place of Ru for forming the lower electrode” (Appellants’ specification, p. 18, ll. 5 – 6), and “a BaSrTiO<sub>3</sub> film 16 acting as a dielectric film is formed ... [and] annealed to form crystals of perovskite structure” (Appellants’ specification, p. 19, ll. 7 – 12). Appellants note that SrRuO<sub>3</sub> also has a perovskite crystal structure, which lends itself to compatibility with the BaSrTiO<sub>3</sub> dielectric film (discussed earlier in the Summary of Invention). Appellants submit that, in addition to not teaching or suggesting at least each and every element of Appellants’ claimed invention, Westmoreland does not effectively disclose an invention to solve crystalline Ru – oxide removal problems that are, in fact, solved by Appellants claimed polishing method.

Turning now to the Danielson reference, the Examiner did admit that “Westmoreland differs [from the present invention] in failing to explicitly teach the addition of the solvent is carried out upon or immediately before the polishing of said substrate, **in claim 17**” (Final Office Action, p. 4, bold in original). The Examiner then broadly alleged that “Danielson teaches a method of preparing an abrasive solution (polishing liquid), mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid...)” (Final Office Action, p. 4). Appellants dispute this allegation, as Danielson’s mixing produces only *one* polishing solution, and this is not equivalent to Appellants’ claimed “adding a solvent for dilution to said first polishing liquid” (claim 17).

Danielson teaches that polishing is carried out after mixing of an abrasive solution and an oxidant solution. *See* Danielson, Abstract. The Examiner alleged that mixing of the abrasive solution and oxidant solution is equivalent to dilution of the abrasive solution (“mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid)” (Final Office Action, p. 4). Appellants submit that the Examiner’s allegations are incorrect. Danielson’s

oxidant solution, disclosed in column 4, lines 28 – 30, is a mixed solution of potassium ferricyanide and an acetate buffer, *and it is not a solvent for the abrasive solution.*

Moreover, Danielson does not cure the deficiencies of Westmoreland to allegedly produce Appellants' claimed invention. Danielson does not teach or suggest "Ru," "Ru compound," "cerium," or even "ions" anywhere in its disclosure. As such, when Danielson's "mixed slurry is delivered immediately to the polishing surface of the polishing pad" (column 5, lines 45 – 46), this is clearly different from Appellants' claimed "adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration" (claim 17). Therefore, the present invention, as recited in independent claim 17, cannot be attained based merely on Danielson's disclosure, taken alone or in combination with Westmoreland.

While the Examiner alleged "it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson's method" (Final Office Action, p. 5), Appellants have already demonstrated herein the impropriety of this combination, as both references do not teach or suggest all the elements of Appellants' independent claim 17, whether they are taken alone or combined together. Therefore, the Examiner's application of Westmoreland and Danielson as references does not satisfy the tenants of a proper 35 U.S.C. § 103(a) rejection. The Examiner has therefore not met an essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P.

§§ 2142, 2143, and 2143.03.

*Suggestion or Motivation to Modify or Combine Reference Teachings*

The M.P.E.P. sets forth:

“However, “The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. *The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant’s specification, to make the necessary changes in the reference device.*” *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984).” M.P.E.P. § 2144.04, italics added.

As such, the present invention, as recited in independent claim 17, cannot be attained based merely on Westmoreland, or on a combination of Westmoreland and Danielson. Even though Appellants have already established that Westmoreland does not teach or suggest all the features of Appellants’ claimed invention, Appellants have demonstrated that the Examiner’s application of Danielson does not render the recitations of Appellants’ claims obvious.

Danielson, taken in combination with Westmoreland, still does not establish that there would have been the requisite suggestion or motivation in either reference to modify them to teach or suggest Appellants’ claimed invention. One skilled in the art would only arrive at the present claimed invention by consulting Appellants’ disclosure. Therefore, the only way to construct the claimed invention from the cited references would be to rely on aspects related to the present invention. Such reliance, however, would constitute improper hindsight reasoning.

There is no suggestion or motivation to modify Westmoreland or Danielson, *in either reference*, to produce Appellants’ claimed invention. Notwithstanding the Examiner’s characterization of the references, the requisite suggestion or motivation to modify them is still not established. “The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the

combination.” M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

As mentioned above, Westmoreland’s invention does not teach or suggest *any* of the recitations of Appellants’ independent claim 17, and Danielson’s teaching of mixing potassium ferricyanide and an acetate buffer with an abrasive, which is not a solvent for an abrasive solution, does not cure Westmoreland’s deficiencies. *These two disclosures diverge both in their aim and in their method of slurry application.* Because of this, their resultant combination cannot be obvious, since, for the reasons presented above, it still would not produce Appellants’ claimed invention.

As already demonstrated, such combination of these references *a priori* fails to establish obviousness of the claimed invention. Furthermore, Appellants have pointed out deficiencies in the cited prior art that render nugatory any indication that the cited references would give any motivation or reason to one of ordinary skill in the art to modify them *without the benefits of Appellants’ specification.* Therefore, Appellants submit that Westmoreland and Danielson do not suggest the desirability of any modification to result in Appellants’ claimed invention, since their combination still would not have produced Appellants’ present claimed invention.

Appellants remind the Examiner that determinations of *prima facie* obviousness must be supported by a finding of “substantial evidence.” *See In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). Specifically, unless “substantial evidence” found in the record supports the factual determinations central to the issue of patentability, *including motivation*, the rejection is improper and should be withdrawn.

The Examiner did not provide any reason why one of ordinary skill in the art would have been motivated to combine the references, other than “for the purpose of creating of slurries

which give superior polish/etch rate (Danielson, column 2, lines 7-10)” (Final Office Action, p. 5).

In this case, Appellants submit that there is no “substantial evidence” in the record to support the combination of Westmoreland and Danielson, and the requisite “clear and particular” motivation required to support a *prima facie* case of obviousness is lacking. The Examiner merely provides an element-by-element analysis, attempting to point out where the references teach the individual elements, but fails to provide more than conclusory statements supporting a motive for achieving Appellants’ claimed combination. (See Final Office Action, pp. 4 – 5).

Therefore, in light of the deficiencies of Westmoreland and Danielson, discussed herein, Appellants submit that the Examiner points to no evidence supporting the notion that a skilled artisan having Westmoreland and Danielson before him/her would have been motivated to combine them to produce Appellants’ present claimed invention. For at least these reasons, the Examiner fails to meet the burden for establishing a *prima facie* case of obviousness.

*Reasonable Expectation of Success Required for Prima Facie Obviousness*

In addition, regarding the required reasonable expectation of success, as evidenced from previous arguments regarding Westmoreland’s and Danielson’s disclosures, Appellants submit that there would be no reasonable expectation of success to be derived from modifying these references, as this would diverge from the elements of Appellants’ claimed invention quoted previously. This also demonstrates that the Examiner’s reliance on Westmoreland and Danielson is not sufficient to establish *prima facie* obviousness. Basically, since these references, taken singly or together, would not have produced the claimed device of the present invention, they would not allow one of ordinary skill in the art to derive any reasonable expectation of success



from combining two references that, in combination, do not even produce the claimed elements of Appellants' invention.

Since Appellants have already demonstrated: (1) deficiencies in the cited references, (2) that they are not combinable to produce the present claimed invention, (3) that they teach away from the present invention, and (4) that they do not provide any suggestion or motivation to produce the present claimed invention, it logically flows that there would be no reasonable expectation of success expected by one of ordinary skill in the art when combining Westmoreland and Danielson.

Conclusion:

In summary, the Examiner has not met any of the essential criteria for establishing a *prima facie* case of obviousness. Appellants have demonstrated above that the Examiner: (a) has not shown that all recitations of Appellants' claimed invention are taught or suggested by Westmoreland and Danielson; (b) has not shown any requisite suggestion or motivation to modify Westmoreland and Danielson to produce Appellants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Westmoreland and Danielson in order to produce the present claimed invention. Thus, Appellants submit that the Examiner's reliance on these references fails to establish *prima facie* obviousness.

Finally, Appellants note that the M.P.E.P. sets forth that "[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03. Therefore, Appellants submit that independent claim 17 is allowable, for the reasons argued above. In addition, dependent claims 11, 18 – 21, and 23 (claim 23 being mentioned only in the body of the rejection, in passing, and not being explicitly rejected) are also allowable at least by virtue of their dependence from allowable base claim 17.



As such, “[i]n the absence of a proper *prima facie* case of obviousness, an Appellant who complies with the other statutory requirements is entitled to a patent. ... On appeal to the Board, an Appellant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness...” *In re Rouffet*, 47 USPQ2d 1453, 1455 (Fed. Cir. 1998).

For all the reasons advanced above, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection, and permit allowance of all the rejected claims.

**C. Claim 12 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, et al. (U.S. Patent No. 4,574,292).**

The rejection of dependent claim 12 under 35 U.S.C. § 103(a) as unpatentable over Westmoreland in view of Danielson as applied to claim 17, and further in view of Takikawa, should be reversed, because the Examiner has failed to establish a *prima facie* case of obviousness.

Appellants disagree with the Examiner’s arguments and conclusions. The Examiner does not show that all the elements of Appellants’ claims are met in Westmoreland and/or Danielson, and does not show that there is any suggestion or motivation to modify the cited references with Takikawa to result in Appellants’ claimed invention. As previously discussed, “[t]o establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.” *See* M.P.E.P. § 2143.03, p. 2100-26.

A *prima facie* case of obviousness has not been made, since Appellants have already demonstrated that Westmoreland and Danielson, taken alone or in combination, fail to teach all of the features of independent claim 17. The Examiner has repeated, multiple times during

prosecution of the present application, that "Westmoreland in view of Danielson differs only in failing to teach the Ru compound is  $\text{SrRuO}_3$ " (Final Office Action, p. 5) This statement, while only partially true, since Westmoreland and Danielson differ from Appellants' invention *in many other ways* (such as those pointed out herein), still does not address the recitations of independent claim 17 that Westmoreland and Danielson fail to teach or suggest. These points were argued conclusively in the previous section, and are supplemented herein to challenge usage of the same arguments as applied to Takikawa.

Appellants contest the Examiner's allegation that "it would have been obvious ... to modify Westmoreland in view of Danielson by using a Ru compound such as  $\text{SrRuO}_3$ " (Final Office Action, p. 5). Appellants submit that the Examiner's statement is an unsubstantiated generalization of questionable relevance to rejected claim 12. Appellants have already established, herein, that  $\text{SrRuO}_3$  has a perovskite crystal structure, and already established that Westmoreland admits not being able to etch crystalline Ru oxide compounds, of which  $\text{SrRuO}_3$  is an example. Appellants also established, herein, that Danielson does not even mention "Ru" or "ruthenium" anywhere in its disclosure. Thus, a combination of Westmoreland and Danielson on this point is improper.

Furthermore, the Examiner introduced Takikawa to allege that "the metal M in the metal oxide film containing Ru and a metal M ... provides a very stable structure of ...  $\text{RuSrO}_3$  (column 2, lines 39-45), which reads on a Ru compound is  $\text{SrRuO}_3$ " (Final Office Action, p. 5). Appellants submit that whether or not Takikawa's "metal M provides a very stable structure of  $\text{RuSrO}_3$ " is irrelevant, *because Takikawa still does not cure the deficiencies of Westmoreland or Danielson*, as it does not teach or suggest the features of Appellants' independent claim 17 not taught or suggested by Westmoreland or Danielson.

Appellants also submit that there is no motivation present *from within Takikawa* to combine it with Westmoreland or Danielson. Takikawa is directed “to a thermal head used in thermal character recording” (column 1, lines 6 – 7), and has nothing to do with Appellants’ claimed polishing methods, or the polishing taught by Westmoreland and Danielson.

The present invention solves problems not addressed by Takikawa, and there is no motivation in Takikawa to modify it to solve the problems Appellants’ have solved with the present invention, since Takikawa directs its attention to thermal character recording problems using thermal heads, which is not related in any way to Appellants’ claimed polishing methods. Similarly, without any motivation with Takikawa to modify it, there can be no reasonable expectation of success from modifying Takikawa in combination with Westmoreland and/or Danielson to attempt somehow to produce Appellants’ present invention.

The Examiner has therefore not met the essential criteria for establishing a *prima facie* case of obviousness. Appellants therefore submit that dependent claim 12 is allowable for the reasons presented herein, and at least by virtue of its dependence from base claim 17. Therefore, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection.

**D. Claim 22 defines patentable subject matter under 35 U.S.C. § 103(a) over Westmoreland in view of Danielson.**

Appellants submit that the rejection of claim 22, based on 35 U.S.C. § 103(a), should be reversed because the Examiner has failed to establish *prima facie* obviousness. Appellants respectfully disagree with the Examiner’s arguments and conclusions, and submit that a *prima facie* case of obviousness has not been established.

The criteria for establishing *prima facie* obviousness have already been set forth. The Examiner does not show that all the elements of Appellants' claim 22 are met in the cited references, does not show that there is any suggestion or motivation to modify the cited references to result in the claimed invention, and does not show there would be any reasonable expectation of success from so doing.

*Prior Art Reference Must Teach or Suggest All the Claim Elements*

Appellants dispute the Examiner's contention that Westmoreland in view of Danielson teach or suggest each and every element of Appellants' claimed invention.

To begin, Appellants respectfully point out to that it "is *impermissible* within the framework of section 103 *to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary* to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art." *See In re Wesslau*, 147 U.S.P.Q. 391 (C.C.P.A. 1965), emphasis added. *See also* M.P.E.P. § 2141.02. Appellants submit that, for the reasons detailed below, the Examiner is only using so much of the cited references to support the Examiner's position, to the exclusion of other parts necessary to give a full appreciation of what the references fairly suggest to one of ordinary skill in the art.

Appellants' independent claim 22 recites, among other things,

"polishing method comprising: preparing a first polishing liquid containing cerium (IV) nitrate in a first concentration; *adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... in a second concentration lower than the first concentration; polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid, wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate*" (italics added).

To explain how Appellants' claimed invention is distinguishable from Westmoreland and Danielson, Appellants raise the following points.

In contrast to the claimed elements of the present invention, Westmoreland discloses a "Ruthenium and Ruthenium Dioxide Removal Method and Material" (Westmoreland, Title). Westmoreland's preferred embodiment teaches that the material is "in the form of a liquid etchant solution" (col. 3, ll. 46 – 47), which "may be an aqueous solution wherein ceric ammonium nitrate, and, optionally, other solutes, are dissolved in liquid water" (col. 3, ll. 47 – 49).

The passages in Westmoreland relied upon by the Examiner to teach formation of the first and second solutions, specifically, Westmoreland, col. 3, ll. 42 – 49 and 55 – 57, merely disclose alternative embodiments of Westmoreland's invention and not the specifically recited two-solution system and polishing method of Appellants' claim 22. Westmoreland discloses material that may be in the form of a liquid etchant solution where the solution "...may be an aqueous solution wherein ceric ammonium nitrate and optionally, other solutes, are dissolved in liquid water" (Westmoreland, col. 3, ll. 42 – 48). While Westmoreland also teaches that it "also provides for a slurry for use in planarization processes, including chemical mechanical planarization" (Westmoreland, col. 5, ll. 23 – 25), Westmoreland refers to only one liquid etchant / slurry solution that may comprise ceric ammonium nitrate and other solutes dissolved in water.

Westmoreland further discloses in one embodiment that the material of the invention "may include about 0.5 to about 70 weight percent ceric ammonium nitrate" (Westmoreland, col. 3, ll. 54 – 56). Contrary to the Examiner's assertion, this language merely further defines the

concentration range of ceric ammonium nitrate in Westmoreland's material, and does not teach or suggest Appellants' claimed: "polishing method comprising ... adding a solvent for dilution to said first polishing liquid to form a second polishing liquid ... wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 22).

As such, the Examiner's allegations have no factual basis. While Westmoreland's examples do, however, teach a single bath used for etching purposes ("Samples of ruthenium and ruthenium dioxide films ... were immersed in a room temperature ... bath of CR-14 Chrome Etchant" (Westmoreland, col. 7, l. 58 – col. 8, l. 1; and also disclosed generally in "Example 2" and "Example 3")), none of Westmoreland's exemplary embodiments teach or suggest all the claimed elements of Appellants' independent claim 22.

Westmoreland is clearly different from Appellants' invention, as claimed in independent claim 17. Simply providing a bath of commercially available "CR-14 Chrome Etchant consist[ing] of 30% by weight ceric ammonium nitrate, 10% by weight acetic acid, and 60% by weight water" (Westmoreland, col. 8, ll. 3 – 5), does not teach or suggest Appellants' claimed:

"first polishing liquid containing cerium (IV) nitrate in a first concentration; adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration," "wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate" (claim 22).

Furthermore, Westmoreland does not teach or suggest an effective invention that can teach the elements of Ru – oxide removal. Westmoreland professes "[a] method for removing at least a portion of a structure, ... including ruthenium metal and/or ruthenium dioxide" (Westmoreland, Abstract), yet Westmoreland presents misleading information to one of ordinary



skill in the art who should otherwise be enabled to make and use his invention. Appellants point to both "Example 2" and "Example 3," wherein Westmoreland discloses "[n]o crystalline ruthenium dioxide was removed by the CR-14 Chrome Etchant" (col. 8, ll. 15 – 17), and "the annealed crystalline ruthenium dioxide film was not etched in the procedure" (col. 8, ll. 58 – 60).

As mentioned earlier in this Appeal Brief, noble metals or *conductive oxides of perovskite-type crystal structure* are chosen for the lower electrodes and dielectric films, *e.g. ruthenium (Ru) and Ru-compounds such as Ru-oxides*, particularly  $\text{SrRuO}_3$ . These materials are ideal for use in DRAMs and FRAMs. Westmoreland admits that crystalline Ru oxides are not removed by his single-step etch bath procedure utilizing a commercially-available Cr etchant. This also contrasts with Appellants' invention, wherein "[a] typical example of the Ru compound that is to be polished in the present invention is  $\text{SrRuO}_3$ " (Appellants' specification, p. 8, ll. 4 – 5; see also Appellants' claim 12, which will be discussed in the subsequent section), where " $\text{SrRuO}_3$  is used in place of Ru for forming the lower electrode" (Appellants' specification, p. 18, ll. 5 – 6), and "a  $\text{BaSrTiO}_3$  film 16 acting as a dielectric film is formed ... [and] annealed to form crystals of perovskite structure" (Appellants' specification, p. 19, ll. 7 – 12). Appellants note that  $\text{SrRuO}_3$  also has a perovskite crystal structure, which lends itself to compatibility with the  $\text{BaSrTiO}_3$  dielectric film (discussed earlier in the Summary of Invention). Appellants submit that, in addition to not teaching or suggesting each and every element of Appellants' claimed invention, Westmoreland does not effectively disclose or suggest an approach to solve crystalline Ru – oxide removal problems that are, in fact, solved by Appellants claimed polishing method.

Turning now to the Danielson reference, the Examiner did admit that "Westmoreland differs [from the present invention] in failing to explicitly teach the addition of the solvent is carried out upon or immediately before the polishing of said substrate" (Final Office Action,



p. 7). The Examiner then broadly alleged that "Danielson teaches a method of preparing an abrasive solution (polishing liquid), mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid) to form a slurry (a second polishing liquid..." (Final Office Action, p. 7). Appellants dispute this allegation, as Danielson's mixing produces only *one* polishing solution, and this is not equivalent to, or compatible with, Appellants' claimed "adding a solvent for dilution to said first polishing liquid" (claim 22).

Danielson teaches that polishing is carried out after mixing of an abrasive solution and an oxidant solution. *See* Danielson, Abstract. The Examiner alleged that mixing of the abrasive solution and oxidant solution is equivalent to dilution of the abrasive solution ("mixing the abrasive solution with an oxidant (same as diluting the initial polishing liquid)" (Final Office Action, p. 7). Appellants submit that the Examiner's allegations are incorrect. Danielson's oxidant solution, disclosed in column 4, lines 28 – 30, is a mixed solution of potassium ferricyanide and an acetate buffer, *and it is not a solvent for the abrasive solution.*

Moreover, Danielson does not cure the deficiencies of Westmoreland to allegedly produce Appellants' claimed invention. Danielson does not teach or suggest "Ru," "Ru compound," "cerium," or even "ions" anywhere in its disclosure. As such, when Danielson's "mixed slurry is delivered immediately to the polishing surface of the polishing pad" (column 5, lines 45 – 46), this is clearly different from Appellants' claimed "addition of the solvent to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration" (claim 22). Therefore, the present invention, as recited in independent claim 22, cannot be attained based merely on Danielson's disclosure, taken alone or in combination with Westmoreland.

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While the Examiner alleged "it would have been obvious to one of ordinary skill in the art at the time of the claimed invention to modify Westmoreland by using Danielson's method" (Final Office Action, p. 7), Appellants have already demonstrated herein the impropriety of this combination, as both references do not teach or suggest all the elements of Appellants' independent claim 22, whether they are taken alone or combined together. Therefore, the Examiner's application of Westmoreland and Danielson as references does not satisfy the tenants of a proper 35 U.S.C. § 103(a) rejection. The Examiner has therefore not met an essential criteria for establishing a *prima facie* case of obviousness, wherein "the prior art reference (or references when combined) must teach or suggest all the claim limitations." See M.P.E.P. §§ 2142, 2143, and 2143.03.

*Suggestion or Motivation to Modify or Combine Reference Teachings*

The M.P.E.P. sets forth:

"However, "The mere fact that a worker in the art could rearrange the parts of the reference device to meet the terms of the claims on appeal is not by itself sufficient to support a finding of obviousness. *The prior art must provide a motivation or reason for the worker in the art, without the benefit of appellant's specification, to make the necessary changes in the reference device.*" *Ex parte Chicago Rawhide Mfg. Co.*, 223 USPQ 351, 353 (Bd. Pat. App. & Inter. 1984)." M.P.E.P. § 2144.04, italics added.

As such, the present invention, as recited in independent claim 22, cannot be attained based merely on Westmoreland, or on a combination of Westmoreland and Danielson. Appellants have already established that Westmoreland does not teach or suggest all the features of Appellants' claimed invention. Appellants have also demonstrated that the Examiner's application of Danielson does not render the recitations of Appellants' claims obvious.

Danielson, taken in combination with Westmoreland, still does not establish that there would have been the requisite suggestion or motivation in either reference to modify them to teach or suggest Appellants' claimed invention. One skilled in the art would only arrive at the present claimed invention by consulting Appellants' disclosure. Therefore, the only way to construct the claimed invention from the cited references would be to rely on aspects related to the present invention. Such reliance, however, would constitute improper hindsight reasoning.

There is no suggestion or motivation to modify Westmoreland or Danielson, *in either reference*, to produce Appellants' claimed invention. Even the Examiner's characterization of the references still does not establish that there would have been the requisite suggestion or motivation to modify them. "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." M.P.E.P. § 2143.01, p. 2100-124, citing *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

As mentioned above, Westmoreland's invention does not teach or suggest *any* of the recitations of Appellants' independent claim 22, and Danielson's teaching of mixing potassium ferricyanide and an acetate buffer with an abrasive, which is not a solvent for an abrasive solution, does not cure Westmoreland's deficiencies. *These two disclosures diverge both in their aim and in their method of slurry application*. Because of this, their resultant combination cannot be obvious, since, for the reasons presented above, it still does not produce Appellants' claimed invention.

As already demonstrated, such combination of these references *a priori* fails to establish obviousness of the claimed invention. Furthermore, Appellants have pointed out deficiencies in the cited prior art that render nugatory any indication that the cited references would give any

motivation or reason to one of ordinary skill in the art to modify them *without the benefits of Appellants' specification*. Therefore, Appellants submit that Westmoreland and Danielson do not suggest the desirability of any modification to result in Appellants' claimed invention, since their combination still does not produce Appellants' present claimed invention.

Appellants remind the Examiner that determinations of *prima facie* obviousness must be supported by a finding of "substantial evidence." *See In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). Specifically, unless "substantial evidence" found in the record supports the factual determinations central to the issue of patentability, *including motivation*, the rejection is improper and should be withdrawn.

The Examiner did not provide any reason why one of ordinary skill in the art would have been motivated to combine the references, other than "for the purpose of creating of slurries which give superior polish/etch rate (Danielson, column 2, lines 7-10)" (Final Office Action, p. 8).

In this case, Appellants submit that there is no "substantial evidence" in the record to support the combination of Westmoreland and Danielson, and the requisite "clear and particular" motivation required to support a *prima facie* case of obviousness is lacking. The Examiner merely provides an element-by-element analysis, attempting to point out where the references teach the individual elements, but fails to provide more than conclusory statements supporting a motive for achieving Appellants' claimed combination. (*See* Final Office Action, pp. 7 – 8).

Therefore, in light of the deficiencies of Westmoreland and Danielson, discussed herein, Appellants submit that the Examiner points to no evidence supporting the notion that a skilled artisan having Westmoreland and Danielson before him/her would have been motivated to

combine them to produce Appellants' present claimed invention. For at least these reasons, the Examiner fails to meet the burden for establishing a *prima facie* case of obviousness.

Reasonable Expectation of Success Required for Prima Facie Obviousness

In addition, regarding the required reasonable expectation of success, as evidenced from previous arguments regarding Westmoreland's and Danielson's disclosures, Appellants submit that there would be no reasonable expectation of success to be derived from modifying these references, as this would diverge from the elements of Appellants' claimed invention, quoted previously. This also demonstrates that the Examiner's reliance on Westmoreland and Danielson is not sufficient to establish *prima facie* obviousness. Basically, since these references, taken singly or together, would not have produced the claimed device of the present invention, they would not allow one of ordinary skill in the art to derive any reasonable expectation of success from combining two references that, in combination, do not even produce the claimed elements of Appellants' invention.

Since Appellants have already demonstrated: (1) deficiencies in the cited references, (2) that they are not combinable to produce the present claimed invention, (3) that they teach away from the present invention, and (4) that they do not provide any suggestion or motivation to produce the present claimed invention, it logically flows that there would be no reasonable expectation of success expected by one of ordinary skill in the art when combining Westmoreland and Danielson.

Conclusion:

In summary, the Examiner has not met any of the essential criteria for establishing a *prima facie* case of obviousness. Appellants have demonstrated above that the Examiner: (a) has not shown that all recitations of Appellants' claimed invention are taught or suggested by

Westmoreland and Danielson; (b) has not shown any requisite suggestion or motivation to modify Westmoreland and Danielson to produce Appellants' claimed invention; and (c) has not shown there would be any reasonable expectation of success from modifying Westmoreland and Danielson in order to produce the present claimed invention. Thus, Appellants submit that the Examiner's reliance on these references fails to establish *prima facie* obviousness.

Finally, Appellants note that the M.P.E.P. sets forth that "[i]f an independent claim is nonobvious under 35 U.S.C. § 103, then any claim depending therefrom is nonobvious." M.P.E.P. § 2143.03. Therefore, Appellants submit that independent claim 22 is allowable, for the reasons argued above. In addition, dependent claim 25 (claim 25 being mentioned only in the body of the rejection, in passing, and not being explicitly rejected) is also allowable at least by virtue of its dependence from allowable base claim 22.

As such, "[i]n the absence of a proper *prima facie* case of obviousness, an Appellant who complies with the other statutory requirements is entitled to a patent. ... On appeal to the Board, an Appellant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness..." *In re Rouffet*, 47 USPQ2d 1453, 1455 (Fed. Cir. 1998).

For all the reasons advanced above, Appellants respectfully request that the Board overturn the improper 35 U.S.C. § 103(a) rejection, and permit allowance of all the rejected claims.

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In making various references to the specification and drawings set forth herein, it is understood that Appellants are in no way intending to limit the scope of the claims to the exemplary embodiments described in the specification and illustrated in the drawings. Rather, Appellants expressly affirm that they are entitled to have the claims interpreted broadly, to the maximum extent permitted by statute, regulation, and applicable case law.

For all the reasons advanced above in the previous sections, the Board should reverse the rejections under 35 U.S.C. § 112, first paragraph, and 35 U.S.C. § 103(a), and permit allowance of all the rejected claims.

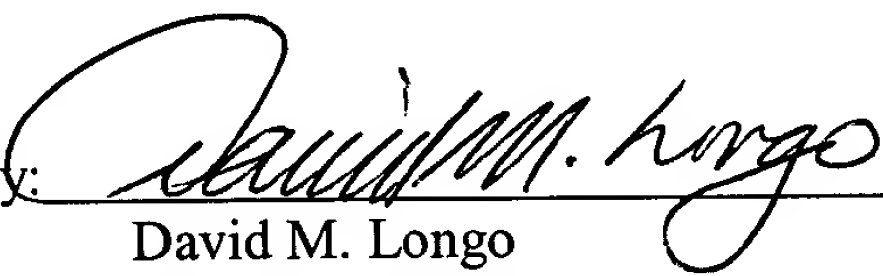
**IX. Appendix**

Attached Appendix A contains a clean copy of claims 11, 12, and 17 – 26 involved in this appeal. Please grant any extensions of time required to enter this Appeal Brief and charge any additional fees required to our Deposit Account No. 06-0916.

Respectfully submitted,

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Dated: October 20, 2003

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**“APPENDIX A” TO APPEAL BRIEF OF October 20, 2003**

11. A polishing method according to claim 17, wherein said second polishing liquid does not contain abrasive grains.

12. A polishing method according to claim 17, wherein said Ru compound is  $\text{SrRuO}_3$ .

17. A polishing method comprising:  
preparing a first polishing liquid containing tetravalent cerium ions in a first concentration;

adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing tetravalent cerium ions in a second concentration lower than the first concentration;

polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid,

wherein said addition of the solvent is carried out upon or immediately before the polishing of said substrate.

18. A polishing method according to claim 17, wherein said second polishing liquid contains cerium (IV) nitrate in a concentration of 0.75% or more by weight.

19. A polishing method according to claim 18, wherein said second polishing liquid contains cerium (IV) nitrate in a concentration of 0.75 to 2% by weight.

20. A polishing method according to claim 17, wherein said second polishing liquid contains diammonium cerium (IV) nitrate in a concentration of 3% or more by weight.

21. A polishing method according to claim 20, wherein said second polishing liquid contains diammonium cerium (IV) nitrate in a concentration of 3 to 8% by weight.

22. A polishing method comprising:  
preparing a first polishing liquid containing cerium (IV) nitrate in a first concentration;  
adding a solvent for dilution to said first polishing liquid to form a second polishing liquid containing cerium (IV) nitrate in a second concentration lower than the first concentration;  
polishing a surface of a substrate containing Ru or a Ru compound in a surface region with the second polishing liquid,  
wherein said adding of the solvent is carried out upon or immediately before the polishing of said substrate.

23. A polishing method according to claim 17, wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute.

24. A polishing method according to claim 17, wherein said solvent consists essentially of water.

25. A polishing method according to claim 22, wherein said solvent has a property of dissolving a solute of said first polishing liquid and does not substantially contain any solute.

26. A polishing method according to claim 22, wherein said solvent consists essentially of water.